JRC Technical Notes

Innovation and Creativity in Education and Training in the EU Member States: Fostering Creative Learning and Supporting Innovative Teaching

Literature review on Innovation and Creativity in E&T in the EU Member States (ICEAC)

Anusca Ferrari, Romina Cachia and Yves Punie

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EXECUTIVE SUMMARY

Creativity and innovation are becoming increasingly important for the development of the 21st century knowledge society. They contribute to economic prosperity as well as to social and individual wellbeing and are essential factors for a more competitive and dynamic Europe. Education is seen as central in fostering creative and innovative skills.

This report provides an overview of the theoretical foundations for creativity and innovation in the context of *education*. It emphasises the need to encourage the development of pupils' and students' creative and innovative potential for several reasons: 1) the upsurge of new media and technologies that learners use in their everyday lives can be exploited in creative and innovative ways and contribute to formal and informal learning; 2) the immersion in this media-rich environment leads new cohorts of students to learn and understand in different ways, therefore teachers need to develop creative approaches and find new methods, solutions and practices to grab their attention; 3) creativity is a form of knowledge creation, therefore stimulating creativity has positive spillover effects onto learning, supporting and enhancing self-learning, learning to learn and life-long learning skills and competences.

Creativity and innovation can play an important role in the knowledge society, as the fruitful interdisciplinary debate presented in this report demonstrates. Creativity is conceptualised as a *skill* for all. It is an ability that everyone can develop and it can therefore be fostered or, likewise, inhibited. Educational actors have the power to unlock the creative and innovative potential of the young.

This report develops the notions of "creative learning" and "innovative teaching". *Creativity* has been defined as a product or process that shows a balance of originality and value. It is a skill, an ability to make unforeseen connections and to generate new and appropriate ideas. *Creative learning* is therefore any learning which involves understanding and new awareness, which allows the learner to go beyond notional acquisition, and focuses on thinking skills. It is based on learner empowerment and centeredness. The creative experience is seen as opposite to the reproductive experience. *Innovation* is the application of such a process or product in order to benefit a domain or field - in this case, teaching. Therefore, *innovative teaching* is the process leading to creative learning, the implementation of new methods, tools and contents which could benefit learners and their creative potential.

Educational actors need to have a clear vision, awareness and understanding of what creativity is and entails in order to fully comprehend how it can be enhanced. Judging the originality and value of an output entails seeing creativity as a relative attribute. The *evaluation* of creativity needs therefore to take into account students' and teachers' perspectives. Moreover, creativity in education has more to do with the process than with the product, and focuses therefore on the development of thinking and cognitive skills.

Creativity and innovation have strong links with *knowledge* and *learning*. While intelligence does not seem to be a precondition for creativity, research shows the relevance of previous knowledge, both in terms of knowing how to be creative and of domain knowledge. Furthermore, creativity is seen by many researchers as a form of knowledge creation and of construction of personal meaning: it is therefore an essential skill for enhancing the learning process. *Creative learning* can be seen as a form of learning that favours understanding over

memorisation. Hence any learning that does not imply mere content acquisition entails a component of creativity.

Creative learning requires *innovative teaching*. Innovative teaching is both the practice of teaching for creativity and of applying innovation to teaching. Both aspects call for an educational culture which values creativity and sees it as an asset in the classroom. Teachers are key figures in constructing a creative climate, but they need support from both policy-makers and institutions. In particular, curricula and assessment are key areas to be addressed in order to allow creativity in the classroom. Curricula should undergo a skilful and thorough development, giving the same importance to every subject, taking creativity into consideration and defining it coherently throughout the curriculum, allowing freedom and time for discovery, and taking learners' interests into account. Assessment should also allow creativity to flourish by valuing it, both at micro, everyday level and at macro, exam level. The three functions of assessment (diagnostic, formative and summative) must contribute to the development of both knowledge acquisition and skills development for learning and creating.

Technologies play a crucial role in learners' lives and can enable educational change towards an innovative and creative school environment. They could act as a platform to foster creative learning and innovative teaching and are currently offering a variety of opportunities for constructive change. However, access to technology is not enough. Accordingly, this report argues that both teachers and learners must acquire the critical skills in their use of technologies to be able to benefit from them in an effective, innovative and creative way. Educational systems should also take into account the empowerment culture brought about by new technologies, putting the learner at the centre of the learning process. Otherwise, there is the risk that education policies and systems become irrelevant for students' real and future needs.

There are other factors, alongside technologies, that support creative learning and innovative teaching. This report highlights the importance of a series of requisites for creativity and innovation in schools. These factors have been called *enablers* and are the circumstances or support mechanisms that make creativity and innovation more likely to thrive. These are: assessment; culture; curriculum; individual skills; teaching and learning format; teachers; technology, tools. The co-existence of several of these factors would give rise to an enabling environment where creative learning and innovative teaching could blossom. If enablers are not present, creativity will be less likely to flourish. If, on the other hand, all enablers are in place, it is still not possible to deduce that creativity and innovation are happening, as teachers and students will still have to actively engage in the creative and innovative process. Enablers are therefore indicators of the kind of environment which could nourish creative learning and innovative teaching.

This report provides the theoretical grounding for creativity and innovation to thrive in a school environment, proposing a series of central factors which can support the shift towards a more creative and innovative education.

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1. INTRODUCTION

1.1. Policy framework

There is a growing interest in and awareness of the role and relevance of creativity and innovation in Europe. It is recognised that Europe needs to strengthen its capacity for creativity and innovation to be able to respond effectively to the development of the knowledge society (EC, 2008a) and to become more competitive in economic and social terms (EC, 2008b).

In March 2000, The European Council set for Europe a strategic goal for the next decade: "to become the most competitive and dynamic knowledge-based economy in the world"[2]. To achieve this ambitious goal, which is part of the Lisbon strategy, Heads of State and Government asked for a transformation of the European economy, and for the modernisation of social welfare and education systems. The Lisbon strategy, a programme focusing on growth and jobs for European competitiveness, underlines the fact that knowledge and innovation are the EU's most valuable assets.

When launching the renewed Lisbon objectives, the 2006 Spring European Council called for a broad-based innovation strategy for Europe, reiterating the commitment to spend more on innovation. It identified education and training as one of the critical factors for a more innovation-friendly Europe.[3] Knowledge and innovation are seen as the beating heart of European growth. In Spring 2008, the European Council stated that European citizens' potential for creativity and innovation is essential for future growth. In its conclusions, Member States and the Commission were requested to develop evidence-based education policy relating to creative and innovative skills; to support research on the promotion of those skills; and to foster creativity and innovation at all levels of education. In addition, the European Parliament gave its support, in September 2008, to the Commission proposal to designate 2009 as the "European Year of Creativity and Innovation".[4] This European Year aims to raise public awareness, spread information and promote public debate on creativity and the capacity for innovation. It also aims to stimulate research into how to develop creative and innovative attitudes and entrepreneurship for personal and professional development. The Council of Europe emphasises the importance of creativity, knowledge, flexibility and innovation in a time of rapid technological change as they enhance citizens' well-being and provide careers opportunities.[5]

Innovation has been at the centre of the European commission agenda for a long time, and it is one of the three key policy areas for the revised Lisbon strategy (EC, 2005). Creativity, a relatively new concept for EU policy-making, has been recognised as the "infinite source of innovation" (EC, 2008c), and therefore indispensable for an innovation shift. Innovation is perceived as the major input for long-term economic growth (EC, 2008c) and for the market to thrive (Aho, 2006). Creativity is a skill which enables individuals to find new solutions, to see things in a different perspective and to generate and evaluate new ideas. Such innovative and creative capacity can only be harnessed to full advantage if it is widely disseminated throughout the European population (EC, 2008a).

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[2] http://www.europarl.europa.eu/bulletins/pdf/1s2000en.pdf
[3] http://www.eu2006.at/en/News/Council_Conclusions/2403EuropeanCouncil.pdf
[4] http://create2009.europa.eu/
[5] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:348:0115:0117:EN:PDF

Especially in times of economic crisis, skills need to be improved in order to enhance employability and, as a consequence, economic growth. Transversal skills, such as problem-solving, self-management or analytical skills are the backbone of new skills for new jobs (EC, 2008d). Political, business and social leaders will therefore have to commit to creating an innovative Europe, as there is an urgent need for a paradigm change (Aho, 2006). The provision of new basic skills has been identified as a priority from pre-school age to post-retirement (EC, 2001, 2002). In the framework of lifelong learning, eight key competences have been identified as being particularly necessary for personal fulfilment and development, social inclusion, active citizenship and employment.[6] These are:

› Communication in the mother tongue;
› Communication in foreign languages;
› Mathematical competence and basic competences in science and technology;
› Digital competence;
› Social and civic competences;
› Sense of initiative and entrepreneurship;
› Cultural awareness and expression;
› Learning to learn.

These competences are interdependent and creativity is one of the transversal skills needed to enhance them. Moreover, creativity, innovation and entrepreneurship are the foundation of the knowledge and education triangles (EC, 2008c).

The European Commission (EC, 2008c) links creativity and innovation to knowledge and sees them as essential skills to be developed in the context of lifelong learning. Creativity concerns all fields of human activity and it can be developed at all levels of education (EC, 2008c). Creativity in turn spurs innovative and entrepreneurial attitudes. In the same background paper on *Lifelong learning for creativity and innovation*, the European Commission (2008c) maintains that education and training are necessary for future innovation, but at the same time innovation is needed to improve education and training. In order to achieve this, learner-centred pedagogies and teachers' empowerment and support are seen as key enabling factors for innovative schools to promote creativity, innovation and entrepreneurship. The paper also recognises the potential that ICT have for fostering change.

Governments are taking part in the debate about Education and Training to meet the challenges of the 21st century, though member states are tackling the issue in different ways (Jeffrey, 2006). To explore these themes, JRC-IPTS has launched a study in collaboration with DG EAC on the role of creativity and innovation in compulsory education. The study aims to review if and how member states are implementing creativity and innovation in their educational policies, to what extent they are supporting them and whether practices reflect these policy priorities.

1.2. Scope of the study

The policy context described above, and the need for creative and innovative competences in Europe's fast changing knowledge society has prompted the IPTS study "Innovation and Creativity in Education and Training in EU member states (ICEAC)". The main aim of this study is to carry out an initial exploration of how creativity and innovation are framed in the

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[6] http://europa.eu/legislation_summaries/education_training_youth/lifelong_learning/c11090_en.htm

EU member states' learning objectives and applied in practice at primary and secondary level. The study is divided into five reports: literature review; assessment and content analysis of the Member States' documents on national learning objectives; a report based on experts' consultation, including a teacher survey and interviews with major stakeholders; a report on good practices; and finally, a report addressing the major conclusions and policy recommendations.

1.3. Objective of the report

This report provides a brief overview of the theoretical foundations for creativity and innovation in the context of education, as a background for the other planned reports. It attempts to define creativity and innovation in the educational context and provide an overview of research on creativity and innovation, especially for creative learning and innovative teaching. It also aims to capture the fruitful interdisciplinary debate on the role of creativity and innovation in the knowledge society and the different schools of thought contributing to this debate.

1.4. Structure of the report

The report is divided into six chapters, the first being the introduction. Chapter 2 considers the current definitions of creativity and innovation from a multi-disciplinary perspective. Chapter 3 will focus on the educational sector, outlining the importance of creativity and innovation for education. Chapter 4 considers the opportunities offered by ICT for creative learning and innovative teaching. Chapter 5 explores the factors that may enable creative learning and innovative teaching. Finally, chapter 6 brings together some of the main messages of the report.

Chapters 2 - 5 aim to answer the following questions:

Chapter 2: Towards a working definition of creativity and innovation

Key question: How can we define creativity and innovation?

Creativity and innovation are multi-disciplinary phenomena (EC, 2008c), they touch on several fields of knowledge and are defined and conceptualised in a variety of ways. They are broad and complex concepts. It is therefore necessary to consider how the literature defines them and to discuss whether these definitions are applicable to our context of study.

Chapter 3: Creativity and innovation in education

Key question: What is the role and function of creativity and innovation in the educational domain?

This section will explore the literature dealing with creativity and innovation in the educational domain. In this context, there are various issues at stake, namely whether creativity and innovation can be taught; how policies can support creative learning and innovative teaching; whether creativity and innovation are cross-curricular skills or associated with particular subjects.

Chapter 4: Technologies for learning, creativity and innovation

Key question: What role does ICT play for creativity and innovation in education?

ICT provide new opportunities for creative learning and innovative teaching and can be a source of pedagogical change. This section will examine the new opportunities for teachers and learners and the support needed to use ICT in creative and innovative ways in education.

Chapter 5: Enabling innovative teaching and creative learning

Key question: What factors are likely to enable (or inhibit) creative learning and innovative teaching?

In order to implement creativity and innovation in their practices, educators need to receive adequate support, both from policy-makers and institutions. If basic conditions (e.g. tools and resources, training, motivation) are not met, then it would be difficult for creative learning and innovative teaching to take place. This chapter will therefore enumerate a series of conditions that enable creative learning and innovative teaching.

2. TOWARDS A WORKING DEFINITION OF CREATIVITY AND INNOVATION

Creativity and innovation are broad, complex and multi-faceted concepts that can be applied to several fields. Their multi-disciplinarity accounts for a variety of approaches and conceptualisations. As Wehner, Csikszentmihalyi and Magyari-Beck (1991) pointed out, the mass of research on creativity can be compared to the elephant in the fable in which blind men have to touch it in order to describe it. As everyone is touching a different part, they all come to a different conclusion as to what it is, and fail to recognise it as an elephant. Indeed, one of the blocks in the study of creativity has been the tendency to conceive one of its aspects as the whole, offering a narrow vision of the phenomenon (Sternberg & Lubart, 1999). It is therefore necessary to consider existing research on creativity and innovation in order to:

› present a holistic approach to the matter and avoid disregarding important aspects;
› validate an appropriate conceptualisation and definition of creativity and innovation;
› identify key factors, issues and concerns which may play an important role in the next phase of this research; and
› address some of the misconceptions of creativity and innovation that are based on common connotations in an attempt to avoid any possible bias concerning the reference framework for our research.

Despite the plethora of approaches, there seems to be a widespread consensus on the definition of both creativity and innovation, even if their application and interpretation differ. Creativity has been understood as the "ability to produce work that is both novel and appropriate" (Sternberg & Lubart, 1999). Innovation has been understood as the "implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations" (OECD, 2005). Craft (2005) sees creativity as the ability to see possibilities that others haven't noticed, Esquivel (1995) sees it as the critical process involved in the generation of new ideas. Innovation has also been defined as the "intentional introduction and application within a job, work team, or organisation of ideas, processes, products, or procedures that are new to that job, work team or organisation and that are designed to benefit the job, work team or organisation" (West & Richards, 1999). Craft (2005) sees innovation as the "implementation of new ideas to create something of value, proven through its uptake in marketplace. An innovation can be seen as a new idea being launched on the market for the first time".

Creativity and innovation are obviously inter-related. Creativity, as mentioned before, is seen as the "infinite source of innovation" (EC, 2008c), and innovation – if one deduces from the above definitions – can in turn be perceived as the application and implementation of creativity (Craft, 2005). Moreover, different fields seem to favour one concept above the other, for instance in business the word "innovation" is used even when it refers to the creative process and work (Sternberg & Lubart, 1999). As innovation can be seen as the application of a creative process or product, the focus of this chapter will be primarily on creativity and on understanding what it is and how it can be framed.

Our first concern is to enhance the conceptualisation of creativity, which is often influenced, as Runco (1999) suggests, by a general implicit understanding and tacit knowledge of creativity. People recognise creativity without being able to define it. The concept of

creativity has been used in several contexts by researchers and non-specialists alike. This extended use of the term has shaped a strong connotative value: creativity is often perceived as synonym for imagination and originality, and is allegedly connected to the visual arts, music and artistic performance. If one were to build on these assumptions, the implication for education would be reductionist: creativity would be seen as the domain of the arts only and therefore restricted to certain specific subjects. Although recognising the relevance of the visual arts, music, drama and the like for a creative education, it should not be forgotten that all areas of knowledge – and all school subjects – can benefit from creativity.

The present chapter will review the major approaches to creativity in an attempt to understand what it denotes. It will then focus on two aspects of creativity that are constantly emerging from the literature: individuality and culture.

2.1. A categorisation of approaches to creativity

Looking into existing research, it is evident that creativity is a complex issue, and difficult to describe. Several fields tackle creativity with their own methods and arrive, as noted before, at different conclusions. It is nevertheless possible to cluster many of these approaches, as more than one researcher has done before (Sternberg & Lubart, 1999; Taylor, 1988; Villalba, 2008). All the approaches entail a specific conceptualisation of creativity and a specific understanding of the concept. The categorisation we propose is based on the aforementioned articles. The aim is to outline a systematisation of the main research areas and to verify which aspects of creativity have been considered as most relevant. It includes:
› Psychometric approach;
› Psychoanalytic approach;
› Self-expression and mystical approach;
› End-product approach;
› Cognitive approach (embracing *phase-oriented studies*, *pragmatic methods* and *thinking theory*).

Psychometric approach
For researchers approaching creativity in a psychometric way, creativity is a quality that can be measured. Guilford suggested that this quality is possessed by everyone – it is therefore not just a characteristic of eminent individuals such as Einstein or Michelangelo (Guilford, 1950). This idea was taken further by Torrance, who developed the Torrance Test of Creative Thinking (Torrance, 1974) in the 60s and 70s. This written test evaluates divergent thinking and problem-solving according to statistical rarity of answers. This approach has been heavily criticised (Almeida, Prieto Prieto, Ferrando, Oliveira, & Ferrándiz, 2008) as it fails to capture and determine what creativity is and how it is expressed. Aside from the pitfalls of the measurements method, the added value of this approach resides in the belief that inventors and eminent creators are not the only people who possess creative abilities.

Psychoanalytic approach
The psychoanalytic approach sees creativity as the manifestation of the unconscious for artistic purposes. Its theoretical background lies in the work of Freud and in the tension between conscious and unconscious processes. Freud was convinced of the need of artists to express their unconscious wishes through a socially acceptable product (Freud, 1958). Under this approach, it is possible to find all the theories that connect pre-conscious or unconscious thinking with the "creative sparkle" (Eigen, 1983), including the research that relates the creative 'eureka' moment to day-dreaming, pre-dreaming, drugs and mental illnesses

(Heilman, Nadeau, & Beversdorf, 2003). This approach has influenced the common and scientific vocabulary regarding creativity.

Self-expression and mystical approach
The self-expression and mystical approach sees creativity as the need to express oneself in a unique way. The emphasis is on aesthetic and expressive outcomes. It is based on common assumptions, implicit theories (Runco, 1999) and connotations, rather than on scientific research. This concept of creativity has often being mingled with associations to talent and inspiration. In ancient times, the creative person was seen as directly inspired by the divine (Sternberg & Lubart, 1999). This mystical approach has been mainly applied to the visual arts, music and writing and can be found in the invocation to the Muses or to God in many literary texts. It is related to the artistic domain and to the idea that creativity cannot be studied (Sternberg & Lubart, 1999). Such a view of creativity gives more emphasis to originality than value, sometimes intertwining creativity with drug use or with mental illnesses (Beghetto, 2005). This approach has an important spill-over effect in education. As Sharp (2004) remarks, most parents (or teachers), when talking about children's creativity, think about artistic or musical talent. This diminishes the role and relevance of creativity in other domains and areas of knowledge and also the concept of creativity as a skill that can be learnt.

End-product approach
The end-product approach sees creativity as a process that results in a product or work or output. Creative experience is thought of as opposite to reproductive experience (Taylor, 1988). While several researchers will not take this approach as their main understanding of creativity, the assumption that creativity is manifested in an output lies behind many theories and is a taken-for-granted factor. This understanding of creativity as a product is evident in design, visual arts, and music, in the "creative industries", where the manufactured goods are perceived as the result of a creative process. The idea permeates the literature, as is evident in many contributions to two reference books on creativity, namely *Theories of Creativity* and *Handbook of creativity*, where the authors tend to identify creativity with creations (Albert & Runco, 1990; Sternberg, 1999a). It has also been acknowledged that not all artistic products are creative (Taylor, 1988).

Cognitive approach
The cognitive approach sees creativity as a cognitive and thinking skill or process. It seeks to understand the thinking process of creative thought (Sternberg & Lubart, 1999). It is possibly the most prominent research area in the creativity debate, and it includes several schools of thought: *phase-oriented studies*, *pragmatic methods*, *thinking theories*. These perspectives have vast overlaps, as they all see creativity as a process and as a mental representation.

Phase-oriented studies explore the different steps of the creativity process. Creativity is not seen as irrational and sudden but as being built on several stages. The Geneplore model (Finke, Ward, & Smith, 1992) distinguishes between a generative phase and an exploratory phase, the first being the construction of the mental representation, the second the interpretation and validation of these constructions. The two phases are not linear, since a non-satisfactory output will bring the thinking process back to the generative phase through a re-focus or expansion of the original concept (see Figure 1).
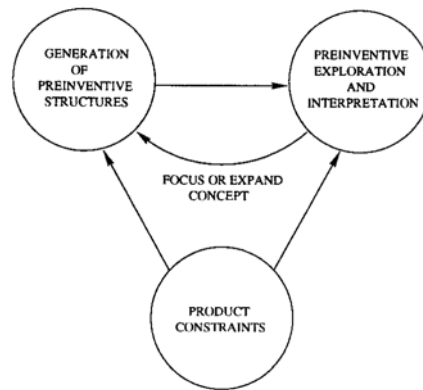
Figure 1: The Geneplore model (Finke, Ward and Smith, 1992)

For Wallas, the creative process consists of four phases: (1) preparation, (2) incubation, (3) illumination and (4) verification (Wallas, 1926). In the first phase the focus is on the problem dimension; in the second the problem is internalised; in the third there is an insight and the birth of a creative idea; and the last phase is about verification, elaboration and validation of the idea. Rossman, studying more than 700 inventors, expanded this model into seven phases: 1. observation of a need; 2. analysis of the need; 3. survey of all available information; 4. formulation of all objective solutions; 5. critical analysis of these solutions; 6. birth of the new idea; 7. experimentation to test, develop and refine the solution (Rossman, 1931). It is evident that Rossman proposed a model that foresees a balance between imagination and analytical skills. The advantage of these models is their descriptive structuring of the creative-thought procedure, which emphasises that creativity does not emerge in mystical or random ways. Moreover, the different stages of the creative process can lead back to the phases of the learning process.

A similar conception of creativity can also be found in *pragmatic methods*, which aim to develop creativity using a series of techniques. One of the first attempts to enhance creativity in such a way was the proposal of brainstorming developed by Alex Osborn. This technique focuses on a group generation of ideas or solutions to a problem and is based on the principle that a constructive atmosphere leads to the development of new ideas and solutions, while a critical and sceptical environment hinders creativity (Osborn, 1953). One of the most popular exponents of the pragmatic method is certainly Edward de Bono, who wrote extensively about creativity. His main concern was to find tools and methods that can take the thinker away from an analytical and critical perspective in order to develop lateral thinking skills and to broaden perception. Among his techniques, the "six hat method" is worth mentioning. It involves "parallel thinking" and is used mainly – but not solely – in meetings or group discussions. Each hat represents a specific line of thought (for example, the white hat is connected to the expression of neutral and objective information; the red hat with feelings and personal opinion; the green hat with new ideas) and participants are asked to "wear a hat" at the time, i.e. to pursue one line of thought or one side of the matter at a time (De Bono, 1985). Other lateral thinking techniques include the use of the linguistic device "po" (Provocative Operation) to attract attention to a possible restructuring of the ideas or issues at hand, to provoke lateral thinking and to attack common assumptions and the Random Input method which simulates 'inspiration' but which may be used to generate new ideas (De Bono, 1970). Other methods for the generations of ideas include the TRIZ tool set and the work of Guy Aznar. TRIZ is a Russian acronym that could be translated as "The theory of inventor's problem solving". It is based on logic methods and denies the role of intuition in the creative process (Altshuller, 1984). Guy Aznar is a French psychologist and economist who wrote about problem-solving, idea-generation and other methods and techniques to foster individual

and group creativity, and his special interest was the application of creativity to business (Aznar, 1973, 2005).

Under the umbrella of *thinking theory,* we cluster several scientific contributions ranging from the studies on personality to environmental variables of creativity.[7] Many focus on the study of genius, trying to establish what personal characteristics made these people become successful scientists, artists, inventors or creators (Albert & Runco, 1990). Others link creativity with the idea of intelligence (Albert & Runco, 1990) or with personal characteristics, such as persuasion (Simonton, 1990). Others focus on environmental factors that influence how creativity is shaped and perceived (Laske, 1993). Others analyse the motivational variables that may trigger or hinder the creative potential (Amabile, 1998).

Robinson (2001) and Albert & Runco (1990) give the example of the scientific revolution as a period of intense creativity, bringing about intellectual paradigm shifts. This comparison certainly suggests that the shaping of creativity is closely related to intellectual development and cultural change. It is assumed that to understand creativity it is also necessary to possess an understanding of both intellect and culture. Since intellect and culture both emerge in the literature as boosting creativity, the following section takes a closer look at these two fundamental aspects of creativity: personal intellectual characteristics and the cultural domain.

2.2. The individual and the creative process

Many studies on creativity consider the personal traits and intellectual abilities of eminent individuals, associating creativity with genius and intelligence (Albert & Runco, 1999), or with knowledge (Weisberg, 1999). It is generally understood that creators or intellectuals possess unique creative ability. Therefore, the work of Picasso, but also of Einstein, Marie Curie and Newton or Leonardo da Vinci, can be seen as creative because at some point, during their lives, these geniuses came up with something original, new and at the same time valuable and appropriate. The study of personality traits of creative and eminent people boosted fertile research on creativity. There are several intellectual traits that have been identified to constitute attributes that foster creativity, which can be found in eminent people and artists and which can indicate how creativity could manifest itself in ordinary people. There are in fact two currents of thought: the first assumes that creativity is a quality and attribute of eminent people; the second recognises that creativity is an ability that the ordinary person can possess. Both *eminent* and *everyday* creativity ask for a specific set of skills.

Creativity requires the simultaneous presence of a number of traits. According to Sternberg and Lubart (1999), creativity requires six elements: intellectual abilities, knowledge, specific styles of thinking, personality and motivation. Three intellectual abilities are seen as particularly necessary: creative or synthetic (the ability to see a problem in new ways and to escape conventional thinking); analytic (see which ideas are worth pursuing); and practical-contextual (persuading others that one's ideas are of value). Regarding the thinking style, they noted a tendency of creative people to look for novelty (Sternberg & Lubart, 1999). They also claim that creative people are those who buy low and sell high in the domain of ideas. They invest their thought in ideas that seem to be unpopular and they sell them high after their creative input, only to go and pursue the next unpopular idea. This has been referred to as the "investment theory" of creativity (Sternberg & Lubart, 1993).

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[7]   Sternberg and Lubart maintain that this approach, which they call the "social-personality approach", has developed in parallel with the cognitive approach (Sternberg & Lubart, 1999). Here, it is seen as part of the cognitive approach as it focuses on the creative thinking process.

For Ng and Smith (2004), creative people are not nice. They define "being nice" as the ability to get along with others with a minimal amount of social friction. Ng and Smith maintain that while a "nice person" agrees with the group, a creative person is dogmatic and will stand for his/her ideas against everything and everyone, as in the case of Galileo Galilei. This characteristic has a negative backwash effect in the classroom, as discussed in Chapter 3.3. For Gardner (1999), creative people are self-confident, ambitious, passionate about their work, and have a tough skin. He maintains that these characteristics are not inborn traits.
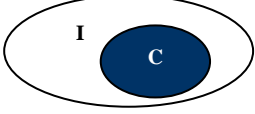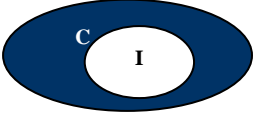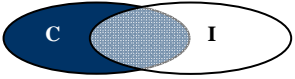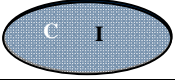
Intelligence has been understood for decades as the central individual characteristic of creative people (Albert & Runco, 1999). We can still see the long tail of this conception in the number of studies that associate creativity with genius or giftedness (Albert & Runco, 1990). The threshold theory suggests that there is a minimum level of intelligence required to be creative (see Figure 2), but that not all intelligent people are creative (Runco, 2007).
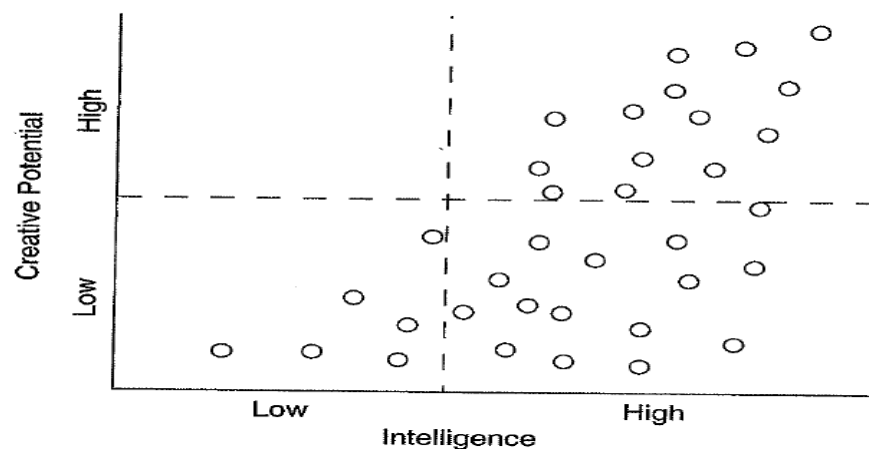
Figure 2: Scatterplot showing the relation between creativity and intelligence (Runco 2007)

Other studies conclude that intelligence is a "necessary but not sufficient component of creativity" (Heilman et al., 2003). Sharp (2004) distinguishes creativity from intelligence and talent. The latter refers to the possession of aptitude and skills in a given area, but does not imply any originality or creative ability in that given area. A good illustration of this could be a musician, whose skills as a performer do not necessarily lead to a creative attitude or ability. Moreover, the relationship between creativity and intelligence can be biased by what we understand by "intelligence". The term generally refers to linguistic and logical mathematical abilities, but it has been pointed out that these skills do not fully cover what intelligence is. Gardner (1983) identifies the existence of eight intelligences: linguistic; logical-mathematical; musical; bodily-kinaesthetic; spatial; interpersonal; intrapersonal; and naturalist. Everyone excels in one or two of these intelligences. Therefore, when establishing a threshold of intelligence, it should be specified which of these intelligences is being considered.

It could be said that the concept of intelligence is possibly as complex as that of creativity. It comes as no surprise that there are contrasting views of the connections between the two. Sternberg (1999b) summarises the research on the topic.
Table 1 gives an overview of Sternberg's categorisation.

Relationship	Main point	Main authors or references
Creativity as a subset of intelligence	Guilford: creativity involves some aspects of intelligence, i.e. divergent thinking. Gardner (multiple intelligences): intelligences can be used in a variety of ways, including fostering creative outcomes.	(Guilford, 1950) (Gardner, 1983)
Intelligence as a subset of creativity	For cognitive processes, creative ability is required more then intellectual ability. Creativity necessitates and involves intelligence and other attributes; therefore intelligence is part of a complex and multi-faceted creative process.	Leon Smith (in Sternberg & O'Hara, 1999) (Sternberg & Lubart, 1993)
Creativity and intelligence as overlapping sets	Creativity and intelligence are similar in some ways, but different in others. Similarities include problem-solving abilities. Differences embrace logical attributes of intelligence opposed to illogical modes of thought for creativity.	IQ tests Implicit theories (Roe, 1976)
Creativity and intelligence as coincident sets	The mechanism underlying creativity are the same that are requested for intelligence. What is judged as creative is simply an extraordinary outcome of a process that involved intelligence.	(Weisberg, 1993)
Creativity and intelligence as disjointed sets	Creativity is not an ability but the result of constant and deliberate practice in a domain. In this view, intelligence has no impact on creative performance.	Anders Ericsson (in Sternberg, 1999b)

Table 1: Review of the research on creativity (C) and intelligence (I) (Sternberg 1999b)

The main message that can be drawn from Sternberg's review is that researchers haven't yet reached a consensus on the relationship between creativity and intelligence. This leaves the issue open, and there is a need to further investigate the field.

Russ (1996) assumes that creativity is manifested in the interplay of three processes: a) personal traits (i.e. tolerance of ambiguity, openness to experience, independence of judgement, unconventional values, curiosity, preference for challenge and complexity, self-confidence, risk-taking, intrinsic motivation); b) emotional or affective processes (i.e. affective fantasy in play, passionate involvement in tasks, affective pleasure in challenge, tolerance of anxiety) and; c) cognitive abilities (i.e. divergent thinking, transformation abilities, sensitivity to problems, tendency to practice with alternative solutions, wide breadth of knowledge, insight ability and evaluative ability).

Another critical aspect of creativity is the amount of knowledge required to be creative. Weisberg (1999) holds knowledge as a fundamental, unquestionable building block of creativity. Previous studies fomented the assumption of an inverted U relationship between creativity and knowledge. According to this theory, little knowledge in one field would hinder creativity, as much as extreme field knowledge (Boden, 2001). Weisberg, however, affirms that great mastery of a field is needed to come out with a creative breakthrough. He refers to the '10 year rule', as several studies on eminent people claim that 10 year's experience in a field is necessary to master the field, and then an additional 10 years to come up with something creative. Deliberate practice and knowledge in a given field positively contribute to creativity. Runco (2007) sustains this view by stating that creative people are recognisable by

their work ethic and persistence. However, knowledge or even mastery of a domain by themselves cannot directly cause creativity (Weisberg, 1999).

Work ethic is not the only value that creative people have in common. For several years Csikszentmihalyi studied creative artists and people embarking on a creative career and found a strong link between values, personality and creativity. In particular, he focused on art students, finding that the most creative among them gave priority to aesthetic values over economic and social values (Csikszentmihalyi, 1990). At the same time, sustained creativity needs sustained and undivided attention to the task at hand (Bohm, 1998). A holistic involvement in the field and/or activity is essential (Sternberg, 1999b), as is the ability to feel rewarded by the activity itself – intrinsic motivation – rather than by external recognition (Csikszentmihalyi, 1990). Motivation is one of the main factors conducive to creative output. Teresa Amabile (1998) wrote extensively on the topic, specifying that intrinsic motivation is more important than extrinsic. For Amabile, intrinsic motivation is about passion and interest, an internal desire to do something. She sees motivation as one of the three components of creativity, the other two being expertise and creative thinking skills (see Figure 3).
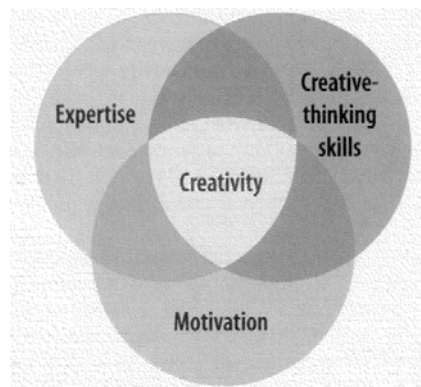
Figure 3: The three components of creativity (Amabile 1998)

Even if all three components of creativity can be improved, motivation, Amabile argues, is the one that can be most immediately influenced by the work environment, as expertise and creative-thinking skills are most difficult and time consuming to influence (Amabile, 1998). She argues that if scientists with skills and expertise lack motivation, they simply will not do the job. Amabile's research maintains that extrinsic motivation (i.e. external rewards) is not enough: a cash incentive is not a magic wand to motivate people. Intrinsic motivation is the major booster for engagement. This brings the argument back to work ethic: creative people are those who are engaged in a task or activity because they derive pleasure from the activity itself. As Csikszentmihalyi (1996) has it: they all love what they do. They experience a mental state of *flow*, being fully immersed in their activity, experiencing an automatic, effortless yet focused state.

2.3. The cultural domain

Another fundamental aspect of the research on creativity seems to be the cultural domain or environment. The ambiguity and vagueness of creativity could reside in the fact that creativity is closely linked to a particular environment and culture (Laske, 1993). As creativity is culturally-bound, it is impossible to define or explain it and one could at best exemplify it. Creativity is an axiological concept, i.e. based on personal judgement of value, not a scientific one (Laske, 1993). Creativity can be considered to be linked to the cultural domain in three different ways: first, the concept of creativity is context dependent and culturally shaped;

second, and idea can only be judged to be creative against a background of previous practices; third, certain environments attract creative people and kindle or kill creative performances.

A cultural shaping of creativity
There is a striking gap between the historical conceptualisation of creativity in the West and in the East. In western world, creativity was traditionally perceived as a god-like quality to create (a divine attribute), whereas in oriental culture (Hindu, Taoist and Buddhist), creativity was understood as mimicry and discovery (Albert & Runco, 1999). As Lubart points out, the divergence in the ontological perspective between East and West involves a different definition of creativity. For western culture, it entails a break with tradition and for eastern culture a reinterpretation of traditional ideas (Lubart, 1999). This brings Lubart to assume that creativity is context dependent (Lubart, 1999). Ng and Smith (2004) also see differences in what Eastern and Western cultures perceive as the cause of success: Eastern cultures tend to attribute success to effort, while Western cultures attribute it to ability. Intelligence is also framed in two opposed ways: a large part of the western tradition sees it as an inherited quality, while in the East it is widely assumed that inborn individual differences in intelligence are minor (Gardner, 1999).

Judging the creativeness of an idea
Csikszentmihaly (1990) proposes a systemic view of creativity. According to him, creativity emerges in the interplay of an individual between a field and a domain (see Figure 4). As creativity is seen as something novel and of value, it has to have a domain of reference, an existing pattern in which to introduce the novelty or the variation. It also needs a field of experts who sanctions this idea, input or product as new and valuable (Csikszentmihalyi, 1999).
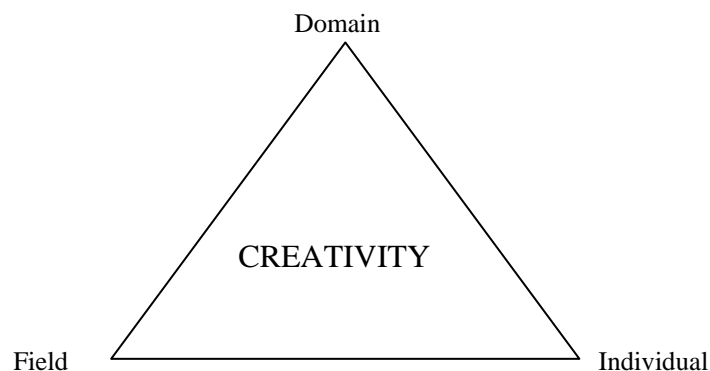
Figure 4: Csikszentmihalyi's creativity triangle

For Csikszentmihalyi, the domain is thus not just the cultural background of creative individuals but also the specific sector in which they operate. Creative people operate in a domain, discipline, or area of knowledge. Their output has value in that particular domain where they excel; it is therefore domain-specific. This explains why creative people are apparently so different and do not constitute a continuum: Picasso and Virginia Wolf have, at a first sight, little in common with Darwin or Galileo Galilei.

A creative environment
Richard Florida (2002) studied the potential of cities to attract creative people. He argues that we actually live in an economy powered by human creativity, and that the key for future economic growth is in attracting and retaining creative people. The economic development race will be won, he maintains, if places are willing and able to become appealing for young talented people. His theory is based on what is known as the 3T model: Technology, Talent

and Tolerance. For a place to be a catalyst of creative talents, it needs to have a high creativity index, which is a balanced mixture of: technological development (Technology), creative class share of the workforce (Talent); and openness towards different people (Tolerance), measured through what Florida called "the Gay index", i.e. the indicator of the Gay presence in a particular town or city. The tolerance index goes in line with the idea that genius and talent cannot survive in repressive societies (Albert & Runco, 1999), genius and talent being seen here as a manifestation of creative abilities. The wider cultural and political context also affects creative performances and attitudes. A repressive society will not value creativity (Craft, 2005). Also, within a specific culture there are sub-cultural sets which influence individual creativity, for instance in the different cultural acceptance there is in a city or in a village, as it can be easier to diverge from the norm in a pluralised space (Craft, 2005). As Gardner (1999) has it, "the right set of genes hardly suffices to yield a creator" (p. 122).

2.4. Major points

The different approaches to creativity suggest that creativity is a process or product which is both new and appropriate (or which has value). Originality and value are the main traits of a creative process or product. Creativity is seen as the source of innovation, and innovation in turn as the implementation of creativity. This chapter has focused on creativity. The transdisciplinary research on the topic shows a variety of approaches, which lead sometimes to contrasting views of what creativity is and is not. From the research, a series of approaches and implications were drawn out in order to systematise the variety of points of view over creativity.

Creative experience can be seen as opposite to reproductive experience (Taylor, 1988). Moreover, creativity is the ability to see possibilities that others haven't noticed (Craft, 2005), the critical process involved in the generation of new ideas (Esquivel, 1995), the possibility to make connections that are not common. It requires cognitive and creative thinking skills, in other words divergent thinking (Runco, 1990) and imagination (Craft, 2005), and also evaluation (Runco, 1990). Creativity also demands a set of personality traits which can be enhanced or modified by the environment. For this reason, the environment needs to nurture creativity and to boost intrinsic motivation. Besides, creativity is not limited to the arts, as it can be manifested in all ambits of human knowledge. Moreover, it should not become an instrumental term to be filled with any kind of content and used in every kind of context (Gibson, 2005). Figure 5 shows a summary of these characteristics: in the outer circle what creativity requires, in the inner shape what creativity is.
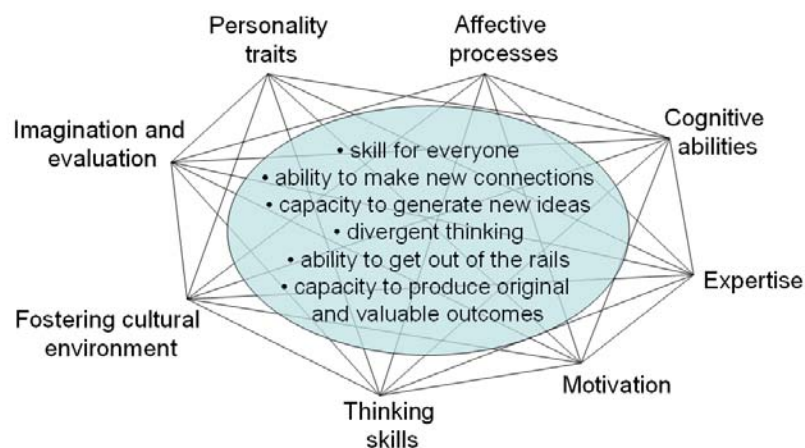

Figure 5: What creativity is and what it requires

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3. CREATIVITY AND INNOVATION IN EDUCATION

Psychometric approaches have highlighted that creativity is often seen as a talent, or as a characteristic of eminent people, and distinctive personality traits have been identified to exemplify a creative mind. At the same time, a number of studies recognise that creativity can be enhanced and cultivated. Craft (in Craft, Jeffrey, & Leibling, 2001) distinguished two different trends in research on creativity and developed the concepts of "big C" and "little c creativity". The first (big C creativity or BCC) refers to the creativity of the genius, seen in people such as Mozart, Picasso, and Einstein. Their creative achievements are exemplary and comprise novelty and excellence in their domain, as well as social recognition and valuation. Little c creativity (LCC), on the other hand, is not for the gifted and talented and does not apply to creative and innovative outbursts that have a strong impact on society. LCC could be seen as behaviour and mental attitude, or as the ability to find new and effective solutions to everyday problems. LCC is not for an extraordinary few. A similar distinction can be found in Shneiderman (2000), who differentiates between revolutionary creativity, imputable to Nobel laureates and geniuses, and evolutionary acts of creativity, which can include doctors making a diagnosis or an editor drafting a magazine.

LCC seems particularly suitable for the educational sector, where a priority is to encourage all students and pupils, who have not yet reached their intellectual peak, to achieve their full potential. This chapter will therefore endorse an inclusive or democratic perspective of creativity, which sees all people as capable of creativity from early childhood onward (Craft, 2005). According to this idea, creative potential can be found in every child (Runco, 2003); it can be encouraged or inhibited (Sharp, 2004); and its development depends on the kind of training people receive (Esquivel, 1995).

Given the benefits of creativity to society and individuals, one would expect to see a celebration of creativity in education (Beghetto, 2005). However, though, there has been a growing interest in the relevance of creativity for teaching and learning since the 1990's (Craft, 2005), it seems that attempts to bring this issue to centre stage have been overshadowed by other efforts, and demands on teachers' and students' schedules (Beghetto, 2005).

This study will argue that creativity and innovation in education are not just an opportunity, but a necessity. First, several emerging trends entail an alteration in the way young people learn and understand (Redecker, 2008). Teachers have to attract students' interest and attention in a new way, and as a result the development of creative approaches is called for (Simplicio, 2000). Secondly, the current and forthcoming cohorts of learners are growing up surrounded by video-games, mobile phones, and other digital media. This overwhelming spread of technologies brings a new understanding of communication, information retrieval and meaning-making. The gap between the school and home digital environment is thus affecting learners' expectations (Pedró, 2006), building up a perception of the current educational framework and format's inadequacy (Selinger, Stewart-Weeks, Wynn, & Cevenini, 2008). Third, creativity has been seen as a form of knowledge creation (Craft, 2005). For all these reasons, it seems clear that creativity and innovation are unavoidable conditions for the present and future of education.

Nevertheless, it must be noted that, in the educational sector, creativity and innovation lose some of their areas of overlapping as discussed at the beginning of Chapter 2. This is mainly

due to the current role of the learner in formal education. Learners are perceived as the end recipient of methods, pedagogies and knowledge. Although they are the major stakeholders in education, their current power to actively contribute to institutional change is limited. Innovation, as stated previously, is the "implementation" (OECD, 2005) or the "intentional introduction and application" (West & Richards, 1999) of a novelty which aims to ameliorate a particular situation. Teaching can be seen as the implementation of methods and pedagogies, and of curricula and contents. Any kind of teaching which addresses creativity and applies it to methods and contents can be seen as innovative teaching. At the same time, the cognitive approach to creativity emphasises its connection to knowledge and thinking skills, bridging the creativity process with learning. For these reasons, this work addresses "creative learning" and "innovative teaching". The first term refers to the possibility for learners to develop their creative skills and to learn in a new, creative way.[8] The second term includes both the process of teaching for creativity and the application of innovation to teaching practices.

This chapter will first focus on creativity as a skill to be developed, adapting the meaning of creativity to the educational framework, identifying the components of creativity in the school setting and exploring the link between creativity and learning. It will then approach innovative teaching, and its implication for formal schooling and the curriculum. It will finally address innovation and propose a change in teaching practice.

3.1.   What is creativity in education?

In education, the term creativity is often used but seldom defined. As Beghetto (2005) points out, teachers might ask students to use their creativity in the design of a project, or might refer to a student's response as creative, without explaining what they mean. A lack of definition of this concept might result in erroneous assumptions (Beghetto, 2005), leading teachers and students to identify creativity only with talent, the arts and personal characteristics.

The transdisciplinary theories on creativity do not help to frame the issue, as they often focus on outstanding performances (Runco, 2003), thus reinforcing the link between natural ability and creative achievements. Research has demonstrated that creative eminent people have in common several personality traits (Simonton, 1990); however this does not mean that creativity is limited to natural ability or talent. On the contrary, creative traits should be identified and studied in order to be able to duplicate and teach them (Simplicio, 2000).

The first step towards creative learning and innovative teaching requires an understanding of the meaning of creativity for education and its implication. This entails a threefold procedure: 1) a de-construction of several current myths about creativity which are leading to a shared misunderstanding of the issue (Sharp, 2004); 2) a discussion and framing of the implications of "newness and value" in the educational context (Craft, 2005); and 3) an emphasis on the process instead of the product (Runco, 2003).

Implicit theories or myths about creativity
As Runco (1999) suggests, teachers, parents, children and other educational actors hold a tacit knowledge about creativity manifested in opinions and expectations, which are in sharp contrast with what the research is showing – and which can have detrimental effects on any attempts to foster creativity in schools. This tacit and shared knowledge builds up a series of "implicit theories", which account for how ordinary people think about creativity. These theories differ from the ones held and scientifically tested by researchers, which Runco calls

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[8]   Creative learning could be the first step for innovative learning.

"explicit theories". Figure 6 shows a series of implicit theories – or myths, as Sharp (2004) sees them – about creativity and the opposite findings of scientific research. The model presented in Figure 6 is an elaboration of Sharp (2004); Beghetto (2007a) and Runco (1999).

Creativity for Education

IMPLICIT		EXPLICIT
	limited to arts	applies to every subject
	pure talent	skill to be learnt
	fun	hard work
	originality	both originality and value
	no prior knowledge	field knowledge is necessary
	major breakthrough	thinking skill
	free play and discovery	stimulation of play and discovery
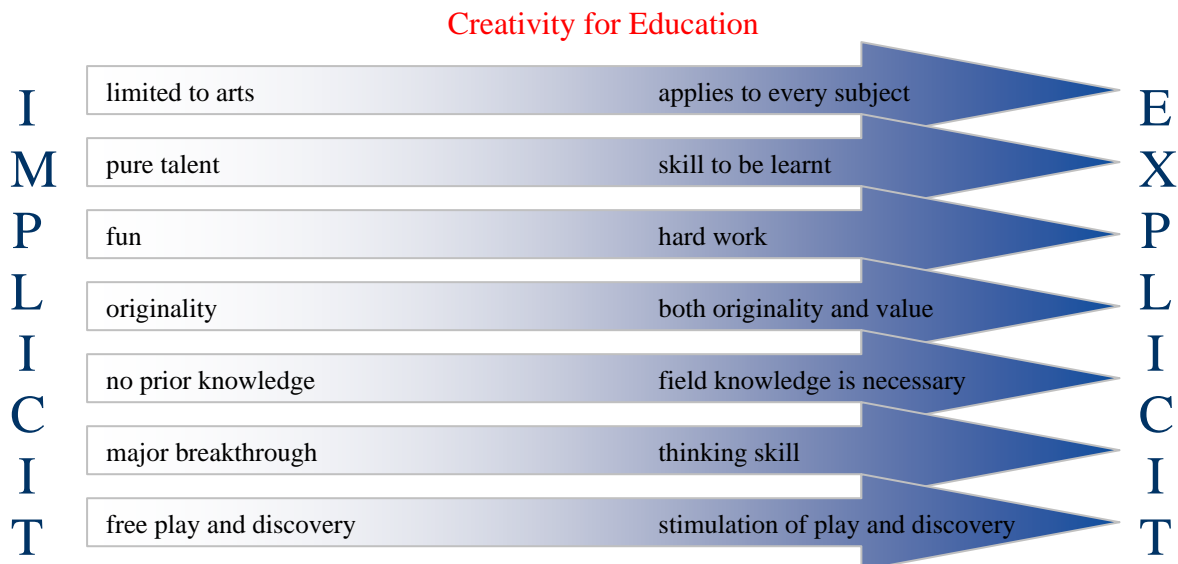
Figure 6: Implicit versus explicit theories of creativity

Understanding creativity means addressing the above issues and being aware of the potential of everyone to become creative (Beghetto, 2007a).

Novelty and value

The current recurring definition of creativity, as mentioned in Chapter 2, stands on the two pillars of "newness and value", which have to co-exist in a creative outcome. The balance between the two concepts is important: something original which has no value could also have negative characteristics (Beghetto, 2005). The application of this definition to education – and to young people in particular – raises a series of questions about the suitability of the two pillars to learners' development and achievement.

It might be questionable to assume that young children and teenagers could have revolutionary breakthrough ideas that are both original and valuable for society. Originality and value have therefore to be understood in their everyday and mundane meaning (Runco, 2003). This entails adopting a democratic, everyday, "little c" definition of creativity (Beghetto, 2005; Sharp, 2004), which recognises the potential of all individuals to be or to become creative (Esquivel, 1995). It is important therefore to consider each child at their stage of development (Sharp, 2004) and to allow for a wide spectrum of creative outputs. For instance, we would expect a greater depth of ability, knowledge and originality in a 16 year old's drawing than in that of a 5 year old (Craft, 2005). Moreover, the creative outputs of children are often original and valuable – hence creative – for the children themselves, but not in comparison with larger norms (Runco, 2003). This leads to a re-thinking of the concept of value, as it has been recognised that the judges of the value of a creative expression are the learners themselves (Craft, 2005; Runco, 2003). For Russ (2003), value and novelty therefore need to be adapted to age groups.

Despite the negotiation of meaning, there is a shared understanding that children have a huge creative potential (Malaguzzi, 1987; Meador, 1992; Robinson, 2006; Runco, 2003). In a study on creativity in young people from pre-school to the age of 17, Meador (1992) measured the originality of individual responses to an alternative uses task. Pupils were given an object and were asked what the object could be used for, and stimulated to give a range of responses, which were then given a positive or negative value according to their uniqueness. The researcher reports that for pre-schoolers the percentage of originality was between 52 and 60%, whereas for older ages it decreased. Nine to 12 year olds had an originality response of 26% and 12 to 17 year olds of 34% (Meador, 1992). Similar findings can be seen in Runco (2003), who asserts that children's creative potential diminishes around the ages of 9-10, when children show a tendency to conform, and they become more self-aware and are conditioned by peer-pressure. Nevertheless, it is worth mentioning that there are contrasting opinions on the creativity of young people, as results are biased by the divergences in the definition of creativity and by its complex nature (Sharp & Le Métais, 2000).

Product or process?
Another aspect of the definition of creativity concerns the emphasis on the process instead of the product (Sharp, 2004). If we look at products and achievements, children will seldom have an opportunity to be judged or to judge themselves creative when compared to adults (Runco, 2003). A similar point can be found in Malaguzzi (1993), who maintains that creativity is more visible when adults pay attention to the process and not to the product. Simplicio (2000) sees creativity as a method and an approach to thinking and living. The focus on the development of thinking skills can be understood as a priority of the process over the product. This line of research has been exploited in particular by the aforementioned cognitive approaches. Moreover, learning is a process. Fostering creativity in learning certainly requires assuming a process-oriented approach.

3.2. Creativity for learning

As argued before, there is a link between creativity, intelligence and knowledge. In the following paragraphs, this relationship will be viewed in an educational context. The connection between creativity and learning will also be discussed.

Intelligence
Chapter 2 discussed some theories on the link between intelligence and creativity. Sternberg concludes that there is no consensus on the relationship between creativity and intelligence. For education, this means that creativity cannot be dismissed on the grounds of the different levels of intelligence one could find in a classroom. It cannot be proved that creativity is an inborn trait; there is therefore a reinforcement of the democratic view of creativity. Among the contrasting findings about the link between creativity and intelligence, the threshold theory seems to be, for the educational context, highly questionable. As mentioned earlier, this theory supposes the existence of a threshold for the intelligence required to be creative, even if it recognises that intelligence alone does not guarantee a creative output (Runco, 2007). Following this theory, it would be easy to assume that focusing on creativity in the classroom would leave out a small portion of those students whose intelligence falls below the threshold. As Runco (2007) points out, the threshold refers to traditional intelligence, which is often associated with academic performance and linguistic/logical fluency or knowledge. In this case, people performing below the threshold have lower knowledge and experience, what Runco calls an *experiential bias*. It has been acknowledged that intelligence could be perceived as something incremental and malleable (Ng & Smith, 2004), as a quality that can be developed and therefore improved (Taylor, 1988). As a consequence, it could be argued

that, if there is a threshold for creative performance, effort should be made to allow every learner to raise their level of intelligence, knowledge and experience above the threshold.

Knowledge

Guilford (1950), in his pioneer study, had already recognised the centrality of knowledge for creativity. Knowledge seems to be a necessary, but not sufficient, condition for creativity (Boden, 2001; Weisberg, 1999). It is nevertheless still unclear how knowledge proficiency shapes creative outputs, as research findings seem to be contradictory, stating on the one hand that extreme expertise will hinder creative outcomes (Simonton, 1990) and on the other that there is no limit to the amount of knowledge needed to be creative (Weisberg, 1999). Knowledge and expertise are unquestionable attributes of the creative eminent mind, regardless of the debate about the amount and the kind of knowledge needed (Scott, 1999).

As regards LCC ("little c" creativity) and education, the kind of background knowledge needed by learners assumes a different nuance. Students require first of all a know-how of creativity, i.e. knowing how to think and how to perceive things in a different way, or how to make connections. Throughout the years which students spend in education, subjects or domain knowledge will become more important: the kind of knowledge needed is incremental from pre-school to university.

Boden (2001) distinguishes three types of creativity, each of them involving a different kind of knowledge-acquisition. *Exploratory creativity* entails the investigation of a given space or field; a sort of "play within the rules" which can be seen for instance in the performance of a jazz musician. This requires some specific and technical knowledge, and it can be said that the creative exploration of the field – in this case of scales, harmonies and melodies – fosters knowledge acquisition. The second type of creativity is what Boden calls *combinational creativity*, which involves the production of new ideas by combining or associating old ones in new unfamiliar ways. The field knowledge here is as necessary as the ability to make connections between stored information. Finally, *transformational creativity* is the significant alteration of one or more of the rules of the conceptual space. Transformational creativity enables the generation of ideas that could not have been thought of before. This kind of creativity is often seen in geniuses and requires a substantial amount of knowledge, as well as self discipline. From a LCC perspective, transformational creativity may happen when an individual thinks about a concept in a completely new way that alters his/her previous understanding of the subject or field. It could be an epiphany, or a revelation, regardless of the fact that society already came to the same conclusions.

All three types of creativity identified by Boden presuppose specific knowledge acquisition, be it subject knowledge, awareness of creative method and approaches, or know-how of both subject-matter and creative attitudes. Knowledge is of substantial importance to trigger a creative outcome; but the reverse is also true. Creativity allows for the making of connections across different areas of knowledge (Burke, 2007). This is an important point, as research shows that students, and especially young children, find it very difficult to transfer learning from one area to another, or to apply former knowledge to a new topic (Sharp, 2004). They need to be trained and taught how to make connections and to build on previous understanding. In turn, this scaffolding allows an expansion of knowledge. The relationship between creativity and knowledge could therefore be seen as a virtuous circle, where creativity stimulates knowledge acquisition and new knowledge permits new and creative thinking paths. In addition, building a creative bridge between different domains results in a holistic approach to knowledge.

Learning

It has just been argued that creativity and knowledge are interdependent. Especially for the educational field, and from a democratic perspective of creativity, taking the individual as the reference for the originality and value pillars leads to an assumption of creativity as a model of understanding and of knowledge creation. Craft (2005) and Runco (2003) certainly support this view. Runco (2003) sees creativity as the construction of personal meaning and Craft (2005) views creativity as a form of knowledge creation.

Learning in a creative way is certainly a form of meaning-making. Current pedagogical discourses attempt to view learners as the centre of teaching and learning processes, with an active role in the production of knowledge and meaning, democratically bringing their expertise, experiences and ideas into the classroom (Williamson & Payton, 2009). Moreover, constructivist approaches to learning involve understanding and making new and valuable connections between old and new knowledge. As Piaget (1973) had claimed, "to understand is to invent". Without invention, learning results in merely memorisation and teaching as a consequence can be viewed as nothing more than imparting notions. Understanding is a form of meaning creation – just as creativity is. Therefore, creativity is an aspect of learning (Craft, 2005). Non-creative learning, on the other hand, comprises all learning that favours memorisation over understanding; rote-learning and learning of facts. Both creative and non-creative learning are important for education and should co-exist. It is unavoidable to go through a certain amount of non-creative learning before being able to make any new connection or to embark on understanding a topic. At the same time, non-creative learning is not enough, as understanding is fundamental for the cognitive and cultural development of children and young people.

A conceptualisation of learning and creativity as "overlapping sets", as Sternberg would have it, leads to a perception of creative teaching as a form of skilful teaching (Craft, 2005). Thus, creativity is not only desirable but also necessary because it involves co-construction of meaning and the learner taking an active role. Creativity enhances learning and makes teaching more effective.

3.3. An educational culture for creativity

Given this research background, one would presume that creativity would be placed at the centre of educational practices. Despite the assumption that creativity is the current icon of the educational world (Gibson, 2005), the claim is that schools (Robinson, 2006) and educators (Malaguzzi, 1987) actually kill creativity. This is because in formal education there is a tendency to look for an "answer that is known before the question is posed" (Malaguzzi, 1987), thus depriving pupils from investigating the issue by themselves. Unfortunately this caters for an academic, logical type of intelligence (Christensen, Johnson, & Horn, 2008), which does not involve all students and all abilities; and it is focused on imparting notions rather than skills (Robinson, 2001). Evidence shows that creativity is not always valued in schools, although creativity and knowledge acquisition can overlap. In an article on future middle and secondary teachers' preferences for students' responses, Beghetto suggests that classroom discussion would be the ideal time for the promotion of creative thinking skills (Beghetto, 2007b). A similar assumption has been made by De Bono, who wrote a textbook to be used in classrooms presenting various techniques to develop thinking skills during classroom interactions (De Bono, 1970). As Beghetto shows, there is a tendency among teachers to prefer standard answers to unique ones; as actual teaching culture does not value creative answers (Beghetto, 2007b). Beghetto also found a delicate balance between relevance

and newness. Teachers place great emphasis on relevance, competence and the need to avoid mistakes – thus hindering the possibility to develop creative skills.

Formal education has created a culture that often "accepts only what is relevant" (Beghetto, 2007b). An aspect of creativity is its *value*, or appropriateness, therefore its relevance, but originality is also important. In schools, newness is dismissed for the sake of contextual relevance. There is, therefore, a need for a paradigm shift, in order to accept and welcome new ideas into the classroom. It may be worth noting that maths secondary school prospective teachers held relevance as most important (Beghetto, 2007b). One of the personality traits of creative people is their capacity to take risks (Davies, 1999), this quality is certainly hindered in a school environment, where the correct, standardised answer is the desired response.

The paradox of desirability is also reflected in teachers' views of the ideal student. Teachers prefer learners who have characteristics that are in sharp contrast with creative personality traits, such as "conforming" and "considerate" (Runco, 1999). Ng and Smith (2004) came to the same conclusion: teachers dislike personality traits associated with creativity. The more creative a class becomes, the less desirable their behaviour appears to teachers, as on the one hand, Ng and Smith maintain, a creative teacher loses an aura of authority, and on the other, creative behaviour in students is often perceived by teachers as associated with scepticism and egoistic manners. In a similar vein, Westby and Dawson (1995) confirmed teachers' negative view of characteristics associated with creativity in students. On the other hand, research shows that creativity is valued by learners (Milgram, 1990). In her study, 500 students were asked what they valued more in teachers, and creativity came out as one of the most valued items. Moreover, it was found that creativity was linked to teachers' effectiveness (Milgram, 1990).

Teaching for creativity, or enhancing learners' creative skills, requires the practitioners to be creative themselves and to provide learners with an ethos and a culture that values creativity (Craft, 2005). This implies a change of the system of values, a *valuation* of creativity (Runco, 2007), where teachers manifest that creativity is worth pursuing. This should reflect a shift in pedagogy, moving towards an inclusive approach (Craft, 2005), where the environment is permissive and safe (Runco, 2007) and where learners are in control of their learning process (Woods, 2002). Developing creative learning therefore demands innovative teaching.

The importance of the teacher figure
Effective teachers are often compared to – and share the same characteristics of – creative teachers (Esquivel, 1995; Milgram, 1990). The creative and effective teacher relies on a series of sources that include ICT, but also realia (i.e. real objects), manipulatives (i.e. resources that can be manipulated), and innovative resources (Simplicio, 2000). They generally do not restrain their lessons to textbooks.

As Wyse and Spendlove (2007) point out, teachers play an important role in triggering students' creativity as they represent the field of experts who are to judge the creative output, as in the Csikszentmihalyi triangle. Teachers are key components (Sharp, 2004) and builders of a creative climate conducive to creative learning (Esquivel, 1995). They provide the balance between structure and freedom of expression and determine the triggering or hindering of students' creative output (Beghetto, 2005). They are the ultimate source of creativity and innovation: no matter how good policies are, they rely on teachers to implement them in class (Ng & Smith, 2004). Teachers should allow the co-construction of knowledge (Craft, 2005), being "reflective practitioners" (Esquivel, 1995), supporters and facilitators

(Sharp, 2004) and not bureaucrats (Ng & Smith, 2004), nor technicians applying governmental policies without questioning them (Craft, 2005) or inhibitors by being overly didactic or prescriptive (Sharp, 2004). Some teachers are traditional, while others are innovative. Research indicates that traditional teachers tend to deter students' individual autonomy (Ng, 2002) which affects their creative performance. Creative performance is more likely to happen with a teacher who empowers students (Craft, 2005). Innovative teachers[9] welcome a democratic classroom (Esquivel, 1995) where everyone has a say. They foster students' independence and empower them (Woods, 2002). Amabile (1989) stresses the importance of a nurturing environment to kindle the creative spark, an environment where students feels rewarded, are active learners, have a sense of ownership, and can freely discuss their problems; where teachers are coaches and promote cooperative learning methods, thus making learning relevant to life experiences.

Teaching for creativity implies allowing pupils to take responsibility for their own learning. Pupils ought not to be considered as merely receivers of information: on the contrary, it is important that they assume the role of discovery, but support and guidance are needed in order for them to succeed. For this, teachers need to be prepared both on the pedagogical side, being aware of the ways and means to foster autonomy and student-centeredness (Simplicio, 2000), and on the subject-knowledge side. Lack of preparation will prevent teachers from being willing and ready to provide a learning format which allows students to discover and explore (Craft, 2005).

The importance of the role of the teacher for creativity and innovation in education puts yet more pressure on the teachers to focus on several priorities and policy agendas at the same time. Teachers are expected to cover the curriculum, meet standards, administer assessment in multiple forms and ever-changing ways (Beghetto, 2005), and focus on literacy and numeracy (Sharp, 2004) or on the current governmental priority (Christensen et al., 2008). They must do all this while being creative and applying innovative, effective and entertaining teaching methods and formats – preferably including ICT. If teachers are the key, support mechanisms should be implemented to make sure they can fulfil expectations and respond positively to requests.

Craft (2005) recognises that there have been several moves to promote creativity in schools in England. Notwithstanding the political effort, messages from the government are conflicting. There is, Craft argues, a tendency to tighten the control of governmental bodies over learning content, assessment, attainment targets, and other educational issues. Teachers are asked to be creative and innovative and, at the same time, they feel the pressure to achieve standards (for instance with the National Literacy strategy and National Numeracy strategy). The same discourse is repeated by Christensen, Johnson and Horn (2008): policy-makers are constantly requesting teachers and institutions to complete some particular task, while never forgetting what was institutionalised beforehand. Tasks, duties and demands accumulate, as new requirements do not shade or substitute the others but are added onto the workload. Implementing creativity in education is particularly challenging, Craft (2005) continues, because the control over teachers' pedagogies and learners' performances is higher than a creative environment could withstand. Creativity needs time, flow, interaction, suspension of judgement, and risk-taking, all these being attitudes that go against traditional school institutional principles. Schools mandate standardisation (Christensen et al., 2008), creativity requires uniqueness.

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[9] By innovative teacher, we mean a teacher who seeks innovation in his/her practice and who teaches for creativity.

The literature recommends taking off some of the pressure, first by giving clear and not conflicting priorities. Moreover, policies should offer a balance between freedom and control, and, most importantly, should provide enough time to teachers and students, away from propositional knowledge, to internalise and experiment (Craft, 2005). It is also important to train teachers and to implement continual professional development, as the needs of learners change at a fast pace (Simplicio, 2000).

3.4. Curricula for creative learning and innovative teaching

Runco (1990) affirms that the thinking of children at all levels of ability is significantly influenced by the type of opportunities they are given. Offering learners the right chances to develop their cognitive and creative potential should be a priority in the design of school curricula. A curriculum is the way in which domains of knowledge are made available to students (Craft, 2005) and it establishes a vision of the kind of society which policy-makers want and envisage for the future (Williamson & Payton, 2009). It may be said that a curriculum is a political act, which involves several stakeholders (Williamson & Payton, 2009), including the parents. Therefore, choices on what to include in the curriculum should benefit not only the learners (Williamson & Payton, 2009), but also meet the demands of different stakeholders.

In order to foster creative learning and innovative teaching, curricula need to undergo a skilful and thorough development, where re-balancing is a key factor. The literature identified several aspects for enhancing the curriculum: the balance between different areas of education; the balance along the curriculum (from pre-school to higher education); the balance between prescription and freedom; and finally the balance between students' interests and other educational stakeholders' agendas.

Balance among different areas
As Craft (2005) argues, creativity is not the preserve of the arts alone, but it can be fostered in all school subjects. Endorsing the implicit theory of creativity as art is a misconception that leads to an underestimation of the potential of creativity for other domains of knowledge.[10] As creativity enhances learning, it should be promoted in all curricular areas. Craft (2005) gives some practical examples of teaching for creativity in different subjects. For instance, in physical education creativity may involve a dance or gymnastic sequence, or collaborative invention of a new ball game. In music, it could imply an individual or collaborative composition. For ICT, it could be inventing a database to answer children's questions about a specific topic. In maths, pupils could identify and solve problems. Wyse and Jones (2003) give some practical guidance to foster creativity, offering both suggestions on specific subjects and providing an overview on how to develop creativity and thinking across the curriculum. Fisher and William (2004) also show how creativity can be developed across the curriculum, offering both theoretical and practical advice on how to develop children's capacity for creative thinking and achievement and use creativity to increase levels of motivation and self-esteem.

The literature states that cross-curricular activities foster creativity in education. Williamson and Payton (2009) suggest paying attention to the division of school subjects and skills. The division of school time in subjects does not allow for the promotion of several skills, such as

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[10] Seeing creativity as a synonym of arts gives rise to a misconception that sees creative activities as synonyms of play and fun (Craft, 2005). There is certainly a playful element, but it should not be forgotten that creativity also involves hard work (Runco, 2007).

learning to learn and thinking skills. Those could be developed within the actual framework, or by setting aside some time for a holistic view of knowledge and for the development of skills that are not subject-specific.

Craft (2005) maintains that, regardless of subject separation or integration, the aim that should underlie the curriculum is understanding a topic or issue. Therefore, subject integration could, at times, be of benefit to the understanding of a cross-curricular theme; whereas, at other times, separating subjects may become necessary. The same view was endorsed by Piaget, who maintains that a mix between cross-curricular work and subject division brings in effective knowledge construction and meaning-making (Piaget, 1973). As studies from Harvard's Project Zero demonstrate, new knowledge is often generated through inter-disciplinary work (in Craft, 2005) as this allows trans-disciplinary thinking. What could be implied from these studies is that dedicating time to cross-curricular work would benefit a holistic approach to knowledge and could trigger creativity in learning.

The Robinson Report highlighted another lack of balance between areas of the curriculum, namely in the distinction between core and foundation subjects. In the National Curriculum of England, there are three core subjects (English, mathematics, science) and seven foundation subjects (technology, history, geography, art, music, physical education and modern foreign languages). Even if other countries may not have such a clear-cut distinction, there is still a hierarchy of areas of knowledge. Schools reflect a cultural background, which gives more relevance to specific fields of knowledge than others. This imposes pressure on policy-makers and teachers, ending up with the attribution of less importance to certain subjects, namely the arts or physical education. The Robinson Report recognises the entitlement of every young person to develop his/her abilities in possibly every field (NACCCE, 1999).

Every student has a different learning style and a different "type of intelligence" (Gardner 1983). Even if people seem to be naturally gifted with one kind of intelligence, they will not accomplish much if they are not given the possibility to develop their particular intelligence (Gardner, 1999). Current curricular structure makes schools more suited to a particular kind of intelligence, whereas schools should cater for all intelligence types. A balance between different domains of knowledge would allow for the provision of opportunities for success for those students who do not possess an 'academic'[11] intelligence (Christensen et al., 2008).

A balance between different areas of the curriculum entails:
› The recognition that all subjects can benefit from creativity, as creativity is not subject-related;
› The possibility to introduce a statutory time for cross-curricular work, as this facilitates a broad vision of education and learning and develops creativity and thinking skills, as well as learning-to-learn skills;
› An acknowledgement of the importance of every domain of knowledge, as this facilitates the catering for different interests, intelligences and learning styles.

Balance along the curriculum
It has been noted that creativity has a different relevance across the curriculum, as intrinsically creative subjects, such as art, seem to allow more space for creativity. On the other hand, it is also true that creativity has an imbalance along the curriculum (i.e. from pre-school to upper secondary), as there are discontinuities in curricular recommendations from

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[11]   Linguistic or logical-mathematical.

early years to secondary school. First of all, there is a stronger emphasis on creativity for younger pupils but not for adolescents. Secondly, creativity is defined and framed in different ways for the early years, for primary and for secondary education (Craft, 2005). Figure 7 provides a view of the relevance of creativity in the Italian curriculum by Michela Ott - ITD-CNR.[12] Michala Ott maintains that in the Italian curriculum the strongest emphasis on creativity is seen at primary level. Moreover, creative skills developed in primary schools function as a trigger for the other stages of education.
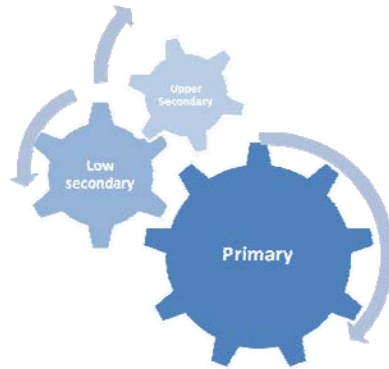
Figure 7: Creativity in the curricula
(Michela Ott)

A balance along the curriculum entails:
›   A recognition of the relevance of creativity for every age group;
›   A coherent definition of creativity from pre-school to university;
›   A detailed framework for creativity in education for all.

Balance between prescription and freedom
There is agreement in the literature that a prescriptive curriculum hinders creativity. The knowledge-burden that teachers are asked to impart certainly has an impact on the time that can be allocated to exploring topics in a creative and innovative way. Craft (2005) believes that the curriculum does not have to involve a great deal of propositional knowledge and has to be covered in a reasonable amount of time, in order to leave space for other activities, for deepening understanding and for developing transversal skills.

An overloaded curriculum will also affect the teaching format. The Robinson Report cites a study by Diane Montgomery, which found that, in over 1,000 lessons, 70% of contact time was taken up by the teacher talking. She assumes that this is partially due by the pressure to cover all the topics of the curriculum (NACCCE, 1999). Woods and Jeffrey (in Craft, 2005) suggest some strategies for practitioners to deliver a heavy curriculum in a creative way by: sharing and creating knowledge; speculating on a given idea/topic; building on prior knowledge; sharing puzzlement (the teacher acting as a learner among other learners); valuing pupils' knowledge; developing common knowledge; problematising knowledge.

A balance between prescription and freedom entails:
›   A recognition of teachers' freedom;

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[12]   The figure is taken from Michela Ott's presentation at the scoping workshop on 'Creativity and *Innovation* in Education' held in Seville on 23-24 February, 2009. To see the full presentation, please go to: http://is.jrc.ec.europa.eu/pages/EAP/documents/Ott.pdf

> › A curriculum which allow space and time for innovation and experiments.

Balance of agendas

As stated earlier, a curriculum is a political act (Williamson & Payton, 2009), affecting several stakeholders. Research has demonstrated that intrinsic motivation is one of the main triggers of creativity (Amabile, 1990). It would therefore be desirable to balance factual knowledge with learners' interests. An interested student is a more creative and engaged learner. Runco (2003) suggests a two-step facilitation effort: first, triggering intrinsic interest; and secondly, matching curriculum and experiences with the individual current level of functioning. For the first step, he suggests educational actors (from policy-makers to teachers) should make an effort to work on topics students find interesting or to find something that might catch students' attention in every topic and subject. For the second step, he builds on constructivist theories, stating that people assimilate information which is slightly ahead of their current functioning. Easy tasks, and also extremely challenging ones, may bore or frustrate the learner, therefore limiting the effectiveness of the teaching and hindering creativity. As it is unlikely that a homogeneous level of functioning within any given classroom will be found, the best solution would be to move towards a personalisation[13] of learning (Williamson & Payton, 2009). The ideal curriculum takes into account every learner's needs and is therefore defined for the individual and not for the group (Runco, 2003).

A balance of agendas entails:
> › A recognition of students' interests when designing the curriculum;
> › The possibility to tailor (personalise) the curriculum to the current level of functioning of each student;
> › Time away from the statutory curriculum to allow space and time for teachers and students to teach and learn what they wish.

3.5. Assessment and creativity

Assessment is an essential component of learning and teaching, as it allows the quality of both teaching and learning to be judged and improved. With regards to creativity and innovation, the Robinson Report noted that the problem with assessment is how it is done, as current methods at best do not take into account creativity, and at worst they stifle it (NACCCE, 1999).

The literature recognises a barrier for creative learning in the way in which formal, national assessment, especially in the form of tests, is currently conducted. Wyse and Jones (2003) maintain that testing has narrowed school provision at the expense of creativity. Notwithstanding the amount of time required to prepare students for examinations, there is no evidence that testing helps to raise standards. On the contrary, the statutory assessment system is considered to divert teaching from activities that would improve teaching and learning quality and attainment (Wyse & Torrance, 2009). The Robinson Report also recognises the pitfalls of assessment for creative learning, as national or end-of-year tests place enormous pressure on teachers and students, who focus on getting a better grade rather than on innovative practices. Assessment often determines the priorities of education (NACCCE, 1999). As a result, if exam papers are asking for notional performances, teaching and learning will tend to focus on propositional knowledge. This reinforces the view that policies should

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[13] This theme is underlined also through the theory of multiple intelligences (Gardner, 1999).

take into account creative learning and innovative teaching in both curricular and testing design.

The same applies to other educational actors, especially teachers. Fostering creative learning with innovative teaching implies a change in assessment, both at a macro and at a micro level. One cannot teach children "how to run and test them on how they jump".[14] Therefore, creativity has to be valued by teachers throughout the whole educational process, from informal judgement to written assignments. Teachers can show that they appreciate creative expression (Beghetto, 2005) and welcome uniqueness of responses, or foster creativity and motivation by giving unusual tasks or assignments (Pleschová, 2007). This attitude does not have to go against standards, since it should not be forgotten that creativity is a balance of novelty and value, thus originality and appropriateness go hand-in-hand.

Simplicio (2000) and Beghetto (2005) agree on the importance of goal-setting: it should be clear for both learners and teachers what has to be learned and how. Beghetto (2005) differentiates between two goal-structure types: *performance* and *mastery*. A performance goal structure highlights the importance of avoiding mistakes, to be the best, to get the highest grades. It is a kind of assessment which makes comparisons among students. A mastery-goal structure emphasises self-improvement and skills development and focuses on learning and not on grading. This assessment provides useful feedback on students' progress and enhances levels of curiosity, motivation, enjoyment and interest, all factors that are crucial in the development of creativity. The framework of *assessment for learning*, though it does not consider creativity, goes in the same direction. It recognises the priority of promoting students' learning and understanding, and highlights the impact of self-assessment and peer-assessment in raising children's achievement (Black, Harrison, Lee, Marshall, & Wiliam, 2004). Assessment therefore monitors students' progress and aims to help students reach their full potential.

Despite the statutory need to take into account the summative function of assessment, which aims to judge – and grade – pupils' achievements at the end of a programme of work, the other two functions must not be forgotten. These are: the diagnostic, which aims to analyse pupils' capabilities and aptitudes as a basis for planning; and the formative, which gathers evidence about pupils' progress to influence teaching methods and priorities (NACCCE, 1999). The main priority of teachers is to help students to focus on understanding and learning rather than on grades (Beghetto, 2005). Simplicio (2000) emphasises the need to measure or evaluate students' performance against previous attainment targets, so that students can see a development in their progression. Knowledge or skills acquisition is not to be compared to other students' performances, as learners have to compete against themselves. Instead of motivating students by suggesting that they will be graded, teachers have to motivate them by getting students involved in their tasks (Beghetto, 2005). Moreover, every learner varies in how they react to assessment; some of them may perform well at written examinations, others at speaking tests or oral exams. Creative and flexible teachers continue to be so when assessing. This can be done by using a variety of assessment methods and by seeing assessment as an extension of the learning process (Simplicio, 2000). If the building and scaffolding of knowledge is co-constructed and personalised, then assessment must also be tailored to the individual.

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[14] Quote from the presentation of Eliza Stefanova at the scoping workshop for Creativity and innovation in education held in Seville on 23rd-24th of February 2009.

Diagnostic assessment has a relevant potential when planning for creative learning and innovative teaching. It is necessary to adapt the concepts of value and novelty to each age group (Russ 2003), so that a solution to a problem, for example, can be judged to be creative for that age group. This could lead to a concept similar to that of reading age, with all its benefits and pitfalls. It is unquestionable that grading creativity may lead to several clashes, as the judgement of the novelty and value of a creative outcome often relies on subjectivity and arbitrariness (Cropley & Cropley, 2007). Ellis and Barrs (2008) recognise the compounded difficulties of assessing creativity, but nevertheless provided a framework and a creative learning scale. The creative learning scale is divided into five levels or attainment targets, accounting for both creative products and processes. Ellis and Barr believe in a kind of assessment that aims to detect creativity, which will also have a backwash effect on fostering creative learning and innovative teaching.[15] Their framework of Creative Learning Assessment (CLA) encompasses diagnostic, formative and summative assessment, allowing teachers to make informal judgements and also to evaluate children's creative work in several ways, including collecting pupils' work in portfolios and e-portfolios.

Table 2 summarises the major points of assessment for creative learning, addressing different forms and functions of assessment, as defined in the Robinson Report (left column) and giving an overview of creative solutions as proposed by several researchers (right column).

Assessment according to the Robinson report	Assessment for creative learning
Forms of assessment	
informal judgements	valuing uniqueness of responses (Beghetto, 2007b), asking open-ended questions and tolerating ambiguity (Sharp, 2004), making informal judgements (Ellis & Barr, 2008).
written, oral or practical assignment	giving unusual assignments (Pleschová, 2007); using a plethora of media (Simplicio, 2000); gathering evidence by using portfolios or course work (NACCCE, 1999).
formal public examination	evaluating creativity in national tests
Functions of assessment	
Diagnostic: To analyse pupils' capabilities and aptitudes as a basis for planning	adapting the concepts of value and novelty to the age group (Russ, 2003).
Formative: To gather evidence about the pupils' progress to influence teaching methods and priorities	goal-oriented attitude, make it explicit that creativity will be valued (Beghetto, 2005) assessment as monitoring of progress (Black et al., 2004).
Summative: To judge pupils' achievements at the end of a programme of work	assess creativity in formal exams (Wyse & Torrance, 2009).

Table 2: a taxonomy of assessment variables and possible creative alternatives

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3.6.   Innovation as a paradigm shift

There is a growing desire for a holistic transformation of educational systems (Selinger et al., 2008). The previous pages have shown how creativity can benefit learning. Creativity allows for the possibility of making connections across different areas of knowledge; there is thus a need for innovative spaces that allow for this cross-cultural and multi-disciplinary approach, which can also include informal knowledge. This approach will thus challenge the actual, traditional configuration of school space, time and structure (Burke, 2007).

Institutions are generally considered to be resistant to change. As Williamson and Payton (2009) point out, any kind of educational change is challenging, messy and slow. Schools, in particular, face an enormous challenge, as there is a pressure to achieve in different areas and as new requirements do not shade or substitute old ones (Christensen et al., 2008; Punie, Cabrera, Bogdanowicz, Zinnbauer, & Navajas, 2005). Moreover, it is quite unlikely that an institution can provide disruptive change. By disruptive innovation, Christensen et al. mean a kind of innovation that is not only preoccupied with the improvement of an existing product (which is called incremental innovation); but which radically changes the paradigms and principles of the product. A good example of the concept is the case of the personal computer. Up until the time of its creation, computers were big, expensive machines that only experts could use. Sustainable innovation made newer, faster, bigger computers. The advent of the personal computer changed the market, as the product was not as "good" or as sophisticated as big computers were, but it targeted another type of client (a previous "non-consumer"). So the introduction of personal computers is a disruptive innovation because it changes the "idea", market and target of computers, even though its base level was not as powerful as the big traditional computers (Christensen et al., 2008). Hargreaves (2003) maintains that the idea that lies behind disruptive innovation is the opposite to that of sustainable innovation.

Schools do not seem to possess the characteristics of innovative organisations, which are generally flexible, welcome ideas, are empowering, tolerate risk, celebrate success, foster synergy and encourage fun (Craft, 2005). Even the implementation of technology in education has not made the foreseen change: ICT has not had the transformative impact it could have had and which was expected (Ala-Mutka, Punie, & Redecker, 2008b). According to Christensen et al. (2008), this is because teachers have used computers to sustain their existing practices, as displacing them would require a kind of disruptive innovation that is not yet feasible. If there is a desire to change education, all educational actors should be involved and must work towards the same goals. Moreover, it is necessary to promote creativity at all levels, as creativity can contribute to both sustainable and disruptive innovation. Innovation cannot happen without creativity.

True innovation in education will require, first of all, a paradigm shift in format and methodology (Simplicio, 2000). This will entail a constant and total renovation, regardless of previous effectiveness. The main actors of change are teachers (Redecker, 2008), but without institutional support they could not only kindle but also kill creativity and innovation. They are the first and most effective source of creativity for learners (Esquivel, 1995), therefore they need both the support and the resources to innovate. Teachers tend to settle in and become comfortable in their profession (Simplicio, 2000). However, teaching careers can last for forty years, and it seems unthinkable to expect that several generations of students would benefit from the same approach (Pedró, 2006). Teachers who wish to be creative have to be willing to change their approach and method (Simplicio, 2000). Teaching creatively and for creativity is not about adding a few pictures to a handout or a presentation, or making students

listen to music.[16] Educators run the risk of falling into the originality pitfall, believing that creativity is a synonym of originality (Beghetto, 2007a). Innovating education involves a complete change in the content and method of teaching, and also in assessment (Simplicio, 2000). There are already pockets of creativity and innovation in several schools around Europe, these "best practices" must become standards for education.

Technology can help to bring about change (Christensen et al., 2008). The development and implementation of student-centric technology will bring a need to shift to student-centred pedagogy and the ownership of learning by learners, a quality that is indispensable for fostering creativity (Woods, 2002). Students could learn with software that is developed for their kind of intelligence and learning style (Christensen et al., 2008). In this way, teachers will not be instructors anymore but rather facilitators (Burke, 2007).

Another path to innovation in education would be the establishment of a network of teachers to disseminate good practice (Hargreaves, 2003). Schools are a good repository of expertise and variety; teachers have therefore to be encouraged to share their expertise through the observation of other teachers within and outside their school (Simplicio, 2000). Another option could be the establishment of an institutional virtual network of expertise, where teachers could exchange resources and tips (Hargreaves, 2003). Again, technologies are fundamental for this kind of transformation, as ICT can be an effective and affordable means of peer-to-peer exchange and networking.[17]

3.7. Major points

This chapter outlined the role and relevance of creativity and innovation in education. For the educational sector, a democratic, "little c" conceptualisation of creativity is more appropriate, as it acknowledges the possibility for everyone to develop their creative potential. This concept entails a re-framing of some aspects of the creative discourse, in particular: implicit theories; novelty and value; and the understanding of creativity as a process or a product. It has been demonstrated that, in order to include creativity in the classroom, implicit theories need to be tackled, to move towards a common understanding of what creativity is. Also, the attributes of novelty and value must be considered for the individual and not for society. Creativity should also be considered as a process more than a product.

Creativity requires experience and knowledge more than intelligence and it can be seen as a form of knowledge creation, and thus linked to learning. Notwithstanding this premise, creativity is not always welcomed in the classroom, especially by the teachers, who often dismiss creative and original outputs on the grounds of their perceived lack of relevance. However, if a creative culture is to be implemented, teachers will be key figures. They therefore need support, both in terms of training and ongoing institutional support.

A re-balancing of the curriculum is required to foster creativity in schools. This entails:
> Recognition of the fact that all subjects can benefit from creativity, as creativity is not subject-related;

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[16] Michela Ott, a senior researcher at the Institute for Educational Technology of the Italian National Research Council who took part in our scoping workshop, pointed out that this is the perception of creativity held by many teachers she interviewed.

[17] See next chapter.

> › The possibility to introduce a statutory time for cross-curricular work, as this facilitates a broad vision of education and learning and develops creativity and thinking skills, as well as learning-to-learn skills;
> › Acknowledgement of the importance of every domain of knowledge, as this facilitates catering for different interests, intelligences and learning styles;
> › Recognition of the relevance of creativity for every age group;
> › A coherent definition of creativity from pre-school to university;
> › A detailed framework for creativity in education for all;
> › Recognition of teachers' freedom;
> › A curriculum which allow space and time for innovation and experimentation;
> › Recognition of students' interests when designing the curriculum;
> › The possibility to tailor (personalise) the curriculum to the current level of functioning of each student;
> › Time away from the statutory curriculum to allow space and time for teachers and students to teach and learn what they wish.

Assessment is also crucial for the development of creative skills. Assessing for creativity (both in national tests and in day-to-day exchanges) will have a positive backwash effect on teaching for creativity. Finally, innovation in education is a hard task for all stakeholders, which requires a paradigm shift in format and methodology. Teachers' networks could help this shift to happen.

4. TECHNOLOGIES FOR LEARNING, CREATIVITY AND INNOVATION

The debate on the role of ICT for creativity and innovation in education has become an important one over the past decade. The rapid development of technology, mainly as a result of the Internet, has brought about an upsurge of technological tools which young people are appropriating for use in their everyday lives. As explored by the domestication theory, the arrival of ICTs in homes has brought the mobilisation of material resources, skills, cultural values and social competences and capabilities (Silverstone, 2006). The recent rise of social media is also having an impact on education. These applications have shifted the way users seek information and the way knowledge is created. The potential of *relational* communities, as opposed to *locational* communities (Bess, Fisher, Sonn, & Bishop, 2002), allows expansion of interests and expertise with people outside one's local community who are interested in the same topics. These new forms of communities facilitate collaboration across space and time. Evolution in communication practices suggests that developments for pedagogy need to address what it means to be educated in our times (Loveless, 2007), so as to avoid 'yesterday's education for tomorrow's kids' (Prensky, 2005).

In the past few years, the emergence of a new wave of technologies has been observed. The rapid uptake of these technologies, which are generally referred to as social computing applications, has also taken many by surprise. Social computing applications vary from social networking sites (like Facebook; MySpace); sharing of bookmarks (del.icio.us; Citeulike); sharing of multimedia (Flickr; YouTube), online gaming (Second Life) and blogging, to mention but a few. These applications offer new opportunities for people to express their creativity, make it available to a large audience and get feedback and recognition (Cachia, Compano, & Da Costa, 2007). Analysis of creative people and artistic innovation demonstrates that scientific and artistic innovation also emerge from collective effort. This is commonly referred to as *social creativity* (Fischer, Giaccardi, Eden, Sugimoto, & Ye, 2005). As discussed by Fischer (Fischer, et al., 2005), an appropriate socio-technical setting can amplify creativity amongst a group of people by augmenting individual creativity and also social creativity.

Blogging is an example of how youngsters are using technologies to express their creativity and to be innovative. Creativity can be at both the individual level and the collective level. These applications demonstrate the variety of ways in which *users learn how to learn*, which according to Rogers (1983), is a major component of creativity. The example of blogging shows that children learn how to write for a public, how to link their work to other works, how to network with other bloggers, how to utilise the blog for their eventual career paths amongst other skills. This facilitates creative learning, as it enables users to use technology to learn in new, creative ways. Such learning processes demonstrate that technology has great potential for creative learning.

Technological skills are important not only for children at schools but also for lifelong learning (EC, 2008c). The different levels of interaction and collaboration characteristic of new technologies facilitate *personalisation of learning paths*. Learners become active stakeholders, who are 'empowered to shape their own learning spaces and resources' and *collaborative learning* processes (Ala-Mutka, Bacigalupo et al., 2008).

Continuous technological change means that learners today need to develop positive attitudes towards change and also, adaptability (Hinkley, 2001). As Hinkley argues, students in the future will endorse 'portfolio careers', moving through several careers and different jobs, including jobs that today still do not exist. Hence, it comes as no surprise that substantial pressure is being put on schooling systems to acknowledge new ways of dealing with continuous rapid technological development. Young people today, often referred to as the *NetGen* or *Google Generation* (Herold, 2009), are growing up surrounded and immersed in technology. Appropriation of technological platforms requires new approaches for education. This section explores how ICT could act as a platform for fostering creative learning and innovative teaching in education and how the education sector may leverage on the opportunities brought about by the new wave of technologies.

Traditionally, creativity has been associated with the artistic world, however, as Florida (2002) argues, creativity is an important component of economic growth and social transformation. Technology, he argues, is one of the major components for fostering future creative communities, together with Talent and Tolerance, what is often referred to as Florida's 3 T's (See section 2.3). In terms of innovation, social computing interfaces are particularly interesting in this debate because in various ways they harness the emerging and increasing role of the user in the innovation-development process, as well as the ongoing shift towards open innovation (Lindmark, forthcoming 2009). Various online applications could be used to empower teachers to become innovative in their teaching, as well as students to develop their creative skills and learn creatively.

4.1. Appropriation of technology

There are different ways in which users interact with technology in learning processes (Loveless, 2008). Interaction with technology is primarily based on how users understand the capacity of technology. Loveless calls this level of learning: 'active learning process'. Interaction with ICT provides users with new ways of doing things: 'extend or enhance ability; novel ways of dealing with a task which might change the nature of the activity itself, or provide limitations and structure which influence the nature and boundaries of the activity' (p. 64). When learning to use a new technology, there are different ways users interact with it. As Loveless argues, it is the interplay of human intention and activity which exploits the potential of a technology.

Learning how to write is one level of learning, while learning how to write novels is another. Writing is a technology which, during Plato's time, was thought of as an external, alien technology (Ong, 1982). Today we have so deeply interiorised writing that it has become a transparent technology. As argued by Ong, when technology is appropriately interiorised, it enhances human life and heightens consciousness. Since its existence, writing has offered various possibilities through which learners can develop their creative skills and learn in new, creative ways. It allows users to deal with tasks in different ways, to find new solutions and to enhance their ways of doing the same task.

Hence, basic technology skills are prerequisites for creative learning. Without basic skills in writing, writing a novel or a poem is more difficult. Literature in this area demonstrates that the digital generation, which is assumed to be totally proficient with technology, often lacks basic technological skills and IT knowledge (Herold, 2009). This shows that if we want children to be creative with technology, we have first and foremost to teach them how to use it. A longitudinal study carried out by the CIBER research team demonstrates that the Google Generation tends to rely heavily on search engines and does not possess the critical and

analytical skills to assess the information they find on the Internet (Rowlands & Fieldhouse, 2008). This is another example which demonstrates how the potential of a medium is not exploited because students have not been taught basic skills which are required when searching for information online.

Research on games has also demonstrated that when games are used in educational contexts, appropriation can take place on different levels. The distinction between diegesis[18] and non-diegesis, borrowed from film studies, explores the different experience of immersion in games and the other role of being outside the game. de Freitas & Oliver (2006) argue that in educational contexts, learners need to be able to enter the world of the game, but also be critical about the process, so as to be able to reflect upon their relationship with the game when viewed from outside. This suggests that creative learning through gaming requires substantial effort from teachers, in order to achieve positive results. Research carried out by the European Schoolnet demonstrates that when teachers used games in their teaching, pupils' motivation and skills were increased (Wastiau, Kearney, & Vanderberghe, 2009).

It is also important to mention that the open innovation culture is changing the way users deal with technology today. A classic example is OpenOffice, a software suite which, through its open system, has encouraged various users to become innovative through the reporting of bugs, requesting new features of enhancing the software. Another more recent example is Facebook's Application Programming Interface (API), which allows third parties to integrate foreign applications. These applications vary from basic gaming to more complex ways of leveraging on social networking.

4.2. Innovative teaching: the role of teachers

Literature and research suggest that technology is endowed with a potential to innovate education (Blandow & Dyrenfurth, 1994; Ruiz i Tarrago, 1993). However, teachers need to modify their teaching methods to accommodate the changed interaction patterns. The effective use of new technologies requires innovative teaching skills. When students are not provided with adequate understanding of the affordances of technologies, there is a high probability that they will replicate familiar forms and ideas using the new tools, as opposed to using the new tools to explore new connections and different ways of fashioning (Loveless, 2008). A study conducted in primary schools on how students used online tools to communicate and participate in online communities highlights the same point (Turvey, 2006). Despite relative autonomy in virtual spaces, most children did not attempt to experiment with the potential of the tools but rather followed predictable patterns of behaviour. This shows that provision of creative spaces and freedom for exploration does not necessarily lead to *creative learning*. The role of the teacher within and outside virtual spaces is important in teaching students how to be creative and innovative.

Teachers' proficiency in using technology is another issue covered in literature (Shaffer, 2006). Teachers, who are not conversant with the technologies they use in their teaching, may not feel comfortable with showing their lack of expertise in front of their students. As Shaffer argues, if a teacher cannot read, it would be difficult for him/her to identify whether a book is bad or whether his/her reading is inadequate to judge the book. When it comes to technology

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[18] "Diegetic," in the cinema, typically refers to the internal world created by the story that the characters themselves experience and encounter: the narrative "space" that includes all the parts of the story, both those that are and those that are not actually shown on the screen (such as events that have led up to the present action) (Definition retrieved from Wikipedia, June 2009)

similar behaviour is noted. In order for innovative teaching to take place, teachers need to be aware of the available resources and how such resources may be useful.

Teachers also need to be able to identify creative processes when they take place. An example given at a conference captures this point clearly. In the UK, it has been observed that one way for teenagers to be popular in class is to download music at home and then be the first to share it with their classmates through a bluetooth application.[19] While for one teacher such an activity may appear frivolous or even a waste of time, for another teacher this activity may represent new ways for youngsters to engage with technology. These teachers may thus leverage on their technical knowledge and try to integrate new ways of teaching using their students' technology. Another example could be integrating the downloading of e-books in classrooms or sharing school resources for a language class.

Many teachers today recognise that a new generation of computer literate learners demand 'sophisticated e-learning resources' and 'support from their instructors' (Wang, Huang, Jeng, & Wang, 2008). However, it is not always clear how teachers should integrate technology in their teaching. Lack of technical personnel to help teachers manage laboratories, as well as the fact that teachers are often not compensated for the extra-time needed to integrate ICT in their teaching, are some challenges and limits imposed by school systems with an ever increasing number of subjects (Bottino, 2003).

Emerging technologies, like for example SNS (Social Networking Sites), are based on notions of networking. In the educational context, networking could enable people to develop collaborative forms of learning. However, most school systems are still based on transmissive models (Bottino, Forcheri, & Molfino, 1998; Noss, 1995). Within such systems, the role of the teacher is fundamental, if creative learning is to take place. Other challenges for teachers highlighted by another study conducted in Denmark relate to: team teaching on the internet (organisational challenges and difficulties); taking ownership and group leadership amongst the students/learners and new aesthetic norms and standards for learning projects (Borgnakke, 2006). This highlights the fact that ICT training for teachers is an important step in making education how it should be today. Teacher training, learning digital competence within context and innovative learning approaches have indeed been highlighted as enablers for pedagogical innovation in the context of ICT in an IPTS Policy Brief (Ala-Mutka, Punie, & Redecker, 2008a).

Another study conducted in Korean schools show that there are six factors which hinder teachers from using games in their teaching, namely: inflexibility of curriculum; negative effects of gaming; students' lack of readiness; lack of supporting materials; fixed class schedules and limited budget (Baek, 2008). An important result of this study, which also reflects findings from the study conducted by the European Schoolnet, is the difficulty encountered by teachers in aligning games with the curricula (Wastiau et al., 2009). These studies also mention the difficulties in locating useful educational games and parents' concern about the usefulness of games in the context of education. In this context, these limitations must be discussed because they could also be hindering innovative teaching.

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[19] This example by presented by Leslie Haddon at the Cost Conference which took place in Copenhagen between 13-15 May 2009 during a session on New Media in the Hands of Young People: http://conference2009.cost298.org/

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4.3. Leisure vs. school work

An ethnographic study conducted in Denmark explored the different learning strategies involved when students interact with technology. Students engaged with a virtual IT project called the 'Middle Ages Project' carried out a range of activities from simple reproduction to sophisticated creation (Borgnakke, 2006). Student behaviour was related to the conflict and the dynamic between desire/duty, play/learning, leisure (for leisure use)/ school (for school use) experienced by the students. These binary distinctions reflect an important debate that has emerged as a result of new technologies. The domestication of media means that most of these applications are used by students at home in their leisure time. Attempts to shift such leisure media for educational purposes have prompted contradictory debates.

While some students would not want their teachers on their Facebook profiles, others would happily do their homework with their peers using Facebook. Breen et al. (2001) suggest that leisure usage of ICT should enable the blending of the academic with the personal. This is perhaps only one side of the story. In our view, more research addressing the blurring of academic and leisure usage of social media is needed. The fusion between leisure and school work is an important debate for this work because there are many instances where creative learning can take place at the hybrid level between leisure and school/work.

The use of games in the educational context has had a positive impact on motivation and other skills (Wastiau et al., 2009). This study shows that students were generally happy that teachers integrated applications from their everyday reality into their educational process. Teachers, on the other hand, found that the use of games in teaching improved students' self-confidence and also were more appropriate when it came to mistakes and different learning rhythms of students. In addition, while students were more prone to retain information and knowledge, teachers were more likely to be innovative in their teaching by combining games with classic teaching aids.

As argued by Prensky (2005), all students have something in their lives which engages them, they enjoy doing and they are good at, 'something that has an engaging, creative component to it' (p. 62). This is often linked to technology and may vary from downloading songs, to playing video games or sharing resources through the Internet, such as pictures or videos. However, such engagement with technology is often ignored at school, resulting in what Prensky calls students becoming 'enraged', as opposed to 'engaged'. Today's education is based on the notion that student 'must eat' what they are fed. This contrasts strongly with the reality offered by new technologies, which empower young users to choose what they want and to create their own personalised identity.

4.4. Technology as an enabler for change

Over the past decade, ICT integration policies have mainly focused on providing access to technology. However, the vast amount of money spent on placing computers at schools has not yielded the expected results in pedagogical change. Bottino (2003) argues that schools have 'crammed' new technologies into their existing structures, as opposed to allowing the new technology to foster a new model, which would allow growth and change in how they operate. According to Bottino, the provision of ICT infrastructure and training does not necessarily result in 'effective pedagogical use of technology in schools'.

On the other hand, it is also argued that technology is endowed with a potential which could enable migration from the present interdependent curricular architecture of most schools to a more modular, student-centric approach (Christensen et al., 2008). Technological solutions

could act as platforms which help teachers to act as mentors and to build new and innovative ways of teaching and for their students to develop their creative skills and to learn in new, creative ways.

Lack of creativity and innovation in schools has also been attributed to technology design. Technologies are often designed for the market rather than for education. It is often the case that teachers are seen as consumers of pre-formed technologies. In this process, suppliers of ICT and teachers are separated. Literature about games also suggests that most games tend to be developed for commercial and leisure purposes (Wastiau et al., 2009). Allowing practitioners into the process of development could enable more innovative and useful products, specifically tailored for education.

It is also important to mention, that even when a real effort is made to bringing about change, by being creative and innovative, this effort does not always yield positive results. In the UK, for instance, the government has dedicated £350 million to creating a "digital curriculum". The idea was to have a game-based document, so as to engage the students. However, as Prensky (2005) argues they are 'struggling in this unfamiliar world'. According to him, creating engagement should be based on good ideas rather than fancy graphics. In the context of creative learning and innovative teaching, the importance of extracting and identifying good ideas cannot be emphasised enough. Loveless (2008) proposes an analytical framework for assessing creative endeavour and outcomes in physical and virtual learning. This is based on: developing ideas; making connections; creating and making; collaboration and communication and evaluation. This suggests that in order to foster creative learning and innovative teaching, assessment in schools should be adapted to, and appropriate for, what we are trying to measure in terms of children's achievements.

The fact that most current education systems are still based on 19th century institutions is another important issue in the literature (Hinkley, 2001). Most of our schools are still using time and space as means of control and as monitorial systems (West-Burnham, 2000). In this context, increased usage of technological applications at home puts pressure on educational institutions to take into consideration the participatory culture of students outside the school and to bring learning closer to the everyday practices of the present student generation (Ala-Mutka, 2008). Curricula design rooted in subject content easily becomes outdated and irrelevant for students' real and future needs (Hinkley, 2001).

4.5.   Major points

This chapter has explored how technology could act as a platform to foster creative learning and innovative teaching. The development for new pedagogies needs to address what it means to be educated in our times. The use of technology at school, however, requires a full understanding of the different levels of technology appropriation by youngsters, in order to leverage on the opportunities brought by technology. This also means that even though technology is endowed with a potential to foster creative learning and innovative teaching, unless teachers change their teaching methods positive results will be limited. Teachers also need to have the required knowledge to be able to identify creative and innovative skills and processes amongst their students. Accordingly, teacher training in these fields is fundamental. In addition to keeping up with rapid technological developments, teachers are also faced with various other challenges imposed by conservative schooling systems and their policies. Teachers therefore need support.

This section also points out the contradictory debate surrounding the use of leisure media for educational purposes, but we believe more research is required in this area. Nonetheless, most of the literature does suggest that the current educational system must consider and explore how to capture the empowerment culture characteristic of new technologies, as these are having an important influence on the learning processes of young people. Until recently, most education policies have focused on access to technology. Little progress has been made in changing school systems in order to allow new technologies to foster new educational models which would, in turn, allow growth and change in how schools operate. It has also been pointed out that the way most schools carry out their assessment and the way curricula are designed may hinder creative learning and innovative teaching. Literature shows that unless education takes into consideration the underlying changing processes brought about by new technologies, there is a risk that education policies become irrelevant for students' real and future needs.

5. ENABLING INNOVATIVE TEACHING AND CREATIVE LEARNING

The previous discussion regarding the framing of creativity and innovation in the broader research and in the educational sector have outlined a variety of perspectives and understandings of these two concepts. There is also a profusion of implicit theories on creativity, which allow people to judge what is creative and innovative without being able to explain or define what creativity and innovation are (Runco, 1999). Both aspects – research and connotations – contribute to the vagueness and elusiveness of the terms, complicating the tasks of looking for creativity and innovation in practice.

At the same time, there is a gap between policies and practices. A support mechanism is needed to facilitate the implementation of policies. This also applies to the discourse of creativity and innovation in education. If member states promote creativity and innovation in their educational policies, this does not guarantee that schools will show creativity and innovation in their day to day practices.

As many researchers found, one of the barriers to creativity and innovation in schools consists of teachers' overloaded schedules. The demand for creative learning and innovative teaching from policy-makers has to be matched with a support mechanism, i.e. with policies and tools that help all educational actors to pursue creative and innovative paths. Besides, policies for creativity and innovation in education need to be in line with other policies and with what is demanded from teachers and students, as contradictory messages will increase uncertainty and further impede the adoption of necessary measures for a creative learning environment. The promotion of creativity and innovation needs to be articulate and coherent, as the issue is complex and multi-faceted. Moreover, policies need to be mirrored by practices, for instance by establishing a nurturing school culture or by finding support in the availability of certain tools, in order to be applied in an effective way and to have a positive impact.

It becomes evident therefore that looking for manifestations of creativity and innovation is challenging for several reasons:
   › Creativity and innovation are processes which do not always result in tangible outcomes and as a result it can be difficult to find evidence of them;
   › Creativity and innovation are exposed to subjectivity, arbitrariness and interpretation; thus making it challenging to compare data;
   › Policies are not necessarily mirrored in practice: encouraging creativity and innovation in policies is not enough, as there is a need for a support mechanism.

The fostering of creativity and innovation does not uniquely rely on the intention of educators and pupils, as there are several conditions to be met before a creative and innovative environment can be promoted. In this sense, policies and common practices may provide the circumstances for creative learning and innovative teaching or, on the contrary, obstruct them. It is therefore interesting and necessary to examine which conditions can trigger creative learning and innovative teaching in order to support and allow them to spread. As Burke puts it, "if creativity is difficult to define, one certain thing is that it is possible to create the conditions in which creativity is more likely to thrive" (Burke, 2007).

As demonstrated, the role of the teacher in formal educational environments is fundamental to bring about new pedagogies or to stimulate change (Ala-Mutka, Bacigalupo et al., 2008).

Teachers need institutional support to be creative and innovative. Nonetheless, an assessment of creativity and innovation in educational practices cannot rely on the fortuitous and incidental number of individuals with the will and the inspiration. It was hence decided to investigate and assess the "enablers" for change. This will allow an understanding of the basic conditions for fostering creative learning and innovative teaching.

By "enablers" we understand the circumstances or the support mechanisms that allow creative learning and innovative teaching to emerge or that facilitate creativity and innovation. As "multiple components must converge for creativity to occur" (Sternberg & Lubart, 1999), it is necessary to "prepare the ground" for creativity and allow for these components (or enablers), to convene. If all enablers are present, it is still not possible to deduce that creativity and innovation are happening, as it ultimately relies on the teachers and students to actively engage in the creative and innovative process. At the same time, if several conditions do not convene, it is unlikely that creativity and innovation will flourish. Enablers are therefore a measure of the possibilities for creativity and innovation, and not of the creative learning and innovative teaching that is actually happening in schools. The gathering, clustering and validation of enablers can have interesting spill-over effects for policy-making: enablers are the conditions and the support mechanism that facilitate and assist creative learning and innovative teaching. They should therefore be taken into account in order to develop educational policies effectively and coherently promoting and supporting creativity and innovation in education.

A twofold method was used to identify major enablers: a literature review and a scoping workshop. During the first phases of the literature review, special attention was paid to the gathering of those aspects that the literature pointed out as being relevant in allowing for creativity and innovation in schools. The results of this data collection were then clustered according to internal similarities or overlapping purpose. A first draft systematisation of the enablers was then presented at a scoping workshop organised by IPTS in Seville on the 23 and 24 February 2009 and attended by experts in the field of creativity and innovation in education. The workshop provided the second phase of the enablers' collection. Attendees were asked to think of the three major enablers for creativity and innovation in formal education. Their opinions were then collected, clustered and discussed in a post-it session. This chapter will give an overview of the actual systematisation of the merging of enablers taken both from research and from the experts' session. Enablers are divided into eight major areas, presented in alphabetical order: Assessment; Culture; Curriculum; Individual skills; Teaching and learning format; Teachers; Technology; Tools.

These areas are wide and loosely defined, in order to allow a variety of conditions to fit under the same domain of concern. All areas have several sub-categories they refer to, in order to specify and detail the conditions for creative learning and innovative teaching. Each area is presented through a table that summarises all sub-categories and links them to the main references.

5.1. Assessment

The generally conflicting interests of stakeholders come together on the issue of assessment. This is because students want to perform well, parents want their children to achieve, teachers may be judged on students' performances and governments may take final scores as evidence of improvement or failure of educational systems. It has been noted that an assessment for creative learning will help students enhance the quality of their learning.

Enablers	Description and references
Assessment	
Assessing for creativity in formal tests	If we support the teaching of creativity, we shall also assess it. Teaching and learning are often shaped around what is required from examinations (Scoping workshop; Wyse, 2003; NACCCE, 1999).
Assessing creativity in day-to-day practices	This will entail adapting the concepts of creativity and innovation to age-group. Also, a framework to assess creativity will bring it to a central stage for both students and learners (Cropley & Cropley, 2007, 2008; Ellis & Barrs, 2008; Russ, 2003).
Valuing creativity	Making learners understand that creativity is welcome. Reward curiosity and exploration (Beghetto, 2005; Runco, 2003).
Formative assessment	Focus on understanding, not on evaluating. Allow for a variety of assessment methods (self-assessment, peer-assessment, portfolios). Assessment is not to judge the students but to help them to understand better (Beghetto, 2005; Simplicio, 2000; Ellis & Barr, 2008).
Making assessment interesting	Assessment does not need to be a stressful situation for the learner. It can also trigger students' imagination and needs to express their creativity. Use of several media to assess pupils – e-portfolios, video-making, projects, etc.; unusual assignments and tasks (Pleschová, 2007).
Minimise social comparison	Students do not have to compete against each-other, but each pupil will benefit from trying to improve his/her previous performances. Need to establish a culture where what matters is the learning and not the grade. This will allow a focus on enjoyment of learning and fosters creative learning (Beghetto, 2005).
Appreciating creative expression	Overcome the "paradox of desirability". Welcome originality in students' performances, contributions and ideas. Find a balance between originality and relevance (Beghetto, 2005, 2007b; Ng & Smith, 2004; Runco, 1999).

Table 3: enabler area 1 - Assessment

5.2. Culture

Creativity and innovation are certainly characterised by a culture of risk-taking rather than one of mistake avoidance. Research shows that there should be a shared belief in creativity as an asset for teachers and students and this belief has to be recognised by all educational stakeholders. The main challenge lies in the values that characterise creativity and innovation (risk-taking, exploration beyond the rules, non-conformity), which are in sharp contrast with school values (standardisation, obedience, relevance and correctness). There is also a need to engage in the creation of a democratic culture, where students' ideas, interests and opinions are welcome. Initial teacher training and continual professional development have been recognised as fundamental in promoting this kind of culture.

Enablers	Description and references
Culture	
Fostering Environment	An environment that recognises creativity in the individual. A tolerant environment, where teachers are the key but students are at the centre of the stage. Fostering a culture that allows students to be able to know when to be original and when to conform. A non-threatening learning environment (Albert & Runco, 1999; Craft, 2005; Csikszentmihalyi, 1999; Esquivel, 1995; Florida, 2002; Runco, 2003; Wyse & Jones, 2003).
Engagement	Giving a good reason to engage in tasks. Recognise students' interest. Culture that rewards hard work but allows fun (Beghetto, 2005).
Creativity as an asset	Culture that recognises and welcomes creativity as a source of deep knowledge and as a thinking skill. Valuation of creativity from all stakeholders. Awareness of what creative learning and innovative teaching mean and entail (Craft, 2005; Runco, 2003).
Risk-taking culture	A culture that welcomes risk-taking, that gives the possibility to try before getting it right. A culture that does not seek for avoiding mistakes (Beghetto, 2005; Davies, 1999; Fisher, 2003).
A democratic culture	Learners have their say. Everyone takes part in the learning process. Co-construction of knowledge and negotiation of meaning. Ownership of learning from learners (Craft et al., 2001; Robinson, 2001).
Open-mindness	From teachers and students alike. Open communication at all levels (including building of trust). Encourage divergence (to broaden the horizon). Understanding of relationship between people, ideas, subject domains, cultures (Scoping workshop).

Table 4: enabler area 3 - culture

5.3. Curriculum

Changes in the curriculum are very often at the centre of a delicate debate. Our interest here is on the recognition of a curriculum that is both effective and facilitates creative learning and innovative teaching. It has been argued before (Chapter 3.4) that the key word for an innovative curriculum is "re-balance".

Enablers	Description and references
Curriculum	
Balance different areas of knowledge	Give the same importance to core and foundation subjects. Address creative learning in all subjects (and not just "the arts"). Teach skills as well as subjects. Allow for cross-curricular work (Craft, 2005; NACCCE, 1999; Piaget, 1973; Williamson & Payton, 2009; Wyse & Jones, 2003).
Avoid competing curricular demand	Emphasis on the need for creativity without making it an extra task in a busy schedule, allowing time (Scoping workshop, Beghetto, 2005, 2007a).
Creativity along the curriculum	Creativity is not just for primary school. The frame and conceptualisation of creativity shall be coherent from primary to secondary school curricula (Craft, 2005).
Balance between prescription and freedom	A prescriptive curriculum hinders creativity. Overloading the curriculum with too much information/knowledge leads to stressful and tight schedules and to a frontal format where the teacher is at the centre of the stage instead of the learner (Craft, 2005; NACCCE, 1999).
Addressing students' interests	Motivation is a main trigger for creativity. Students learn best when they see the relevance of what they are doing and when they are intrinsically interested in the activity or task. A good curriculum that promotes creativity needs to consider, among other things, also students interests (Scoping workshop, Runco, 2003; Williamson & Payton, 2009).

Table 5: enabler area 2 - curriculum

5.4. Individual skills

Trans-disciplinary research and the literature on creativity and innovation for education emphasise the importance of individual skills. Students can develop certain attitudes, abilities and knowledge in order to perform in creative ways. Teachers will also need to widen their experience and expertise to become advocates and practitioners of creativity and innovation in schools.

Enablers	Description and references
Individual Skills	
Intellectual abilities	Students and teachers: develop synthetic, analytic and practical-contextual abilities (Sternberg & Lubart, 1999).
Knowledge	There is a minimum threshold of knowledge needed to be creative in any field. Moreover, learners and teachers will have to know how to think, how to make connections, how to seek for problems and how to solve them (Boden, 2001; Sternberg & Lubart, 1999).
Experience	Being an expert or having some expertise in a given field is a requirement for being creative (Scoping workshop; Amabile, 1998).
Cognitive abilities	Divergent thinking, tendency to practice with alternative solutions, sensitivity to problems, evaluative ability (Russ, 1996; Sternberg & Lubart, 1999).
Personality	Certain personality traits shall be welcomed and fostered in class: tolerance of ambiguity, openness to experience, independence of judgement, unconventional values, curiosity, preference for challenges and complexity, self-confidence, risk-taking (Russ, 1996; Sternberg & Lubart, 1999).
Motivation	Intrinsic interest in the topic (from students and teachers). Work slightly ahead of learners' current functioning (Amabile, 1998; Runco, 2003; Sternberg & Lubart, 1999).
Hard Work	Creativity is not just fun but requires hard work (Runco 2007).

Table 6: enabler area 4 - individual skills

5.5. Teaching and learning format

A change in content and perspective also demands a change in pedagogy. Current educational systems need to adopt new methods that are suitable for present and future learners. In line with this, fostering creativity also requires an active mode of learning, and consequently a

new teaching format, where the teacher is a coach and supporter and learners are empowered to take ownership of their own learning process.

Enablers	Description and references
Teaching / Learning Format	
Teaching for creativity	Teachers to tell the students that they value creativity. Making creativity explicit by supporting teachers to teach it (Runco 1990; Ellis & Barr, 2008).
Co-production of knowledge	A democratic classroom, where everyone has a say. Learners have an active role in the production and negotiation of meaning. Their ideas are welcome. Ownership of learning. Co-operative work (Scoping workshop; Craft, 2005; Jeffrey, 2005; Runco, 2003).
Positive involvement	Fostering passionate involvement in tasks, affective fantasy in play, tolerance of anxiety (Russ, 1996).
Adapting format to the changing needs of students	Today's learners learn in a different way. They are surrounded by technologies. They understand differently. There is a need to change the format at greater pace than in the past (Pedró, 2006; Redecker, 2008; Simplicio, 2000).
Adapting creativity to age group	Being creative means different things at different stages/ages. When planning for innovative teaching, there is a need to tailor content and method to students' interest, current level of functioning and current or proximal abilities (Runco, 2003; Russ, 2003).
Focus on creative processes rather than products	Creativity can be understood both as a product and a process. Focusing on the process allows for the development of thinking skills and for cultivating the right climate for creative learning and innovative teaching (Malaguzzi, 1993; Runco, 2003; Sharp, 2004).
Intrinsic motivation	Intrinsic motivation, i.e. the pleasure of being involved in a given task, is a booster of creativity. It also enhances effective learning (Amabile, 1989; Runco, 2007).
High-expectation of creative potential	Have high expectation from students, for both their learning and their creative potential. This will help students' self-esteem and trigger their motivation. Belief that everyone has the potential to be or become creative (Craft, 2005; Robinson, 2001; Wyse & Jones, 2003).
Learners as thinkers	Learners are treated as thinkers. Provocative methods to stimulate responses and interest. Learners think about the matter in between classes (Taylor, 1988).
Pupil-centeredness	Need of a learner-centred pedagogy, personalisation and individualisation of learning, allowing pupils to have a say in the fashioning of tasks (Scoping workshop; Craft, 2005; Williamson, 2009).

Table 7: enabler area 5 - teaching/learning format

5.6. Teachers

Teachers play a very important role in the kindling or stifling of creativity and innovation in education. They need to be made aware of the opportunities offered by creative learning and innovative teaching. Most of all, they need support.

Enabler	Description and references
Teachers	
Training on creativity	Training is fundamental to acquire new skills, techniques and method to be innovative and creative, support professional development (Esquivel, 1995; Ellis & Barr, 2008).
Understanding of what creativity is	Need to tackle myths, implicit theories and common assumptions on creativity. Need to understand what creativity is and how to look for and foster it (Beghetto, 2007a; Runco, 1999; Sharp, 2004).
Valuing creativity in students	Teachers need to welcome creativity, acknowledging the balance between originality and value. They need to make it clear for students that creativity is well received (Beghetto, 2007b; Craft, 2005; Runco, 1999, 2007).
Be creative	Teachers need to be creative, to implement creativity in their practice if they want to teach in an innovative and creative way (Craft, 2005).
Support from technical personnel	Teachers require technical support, extra time and supporting material to integrate technologies in their teaching (Bottino, 2003; Baek, 2008).
Time	Time away from curriculum, to innovate, assimilate, try and explore (Scoping workshop).

Table 8: enabler area 6 – teachers

5.7. Technology

Technologies offer great opportunities for change. They can act as a platform for innovative teaching and creative learning in many ways, as they entail new ways of fashioning knowledge creation and meaning making.

Enablers	Description and references
Technology	
Sharing of resources, social networking & collaboration	New opportunities offered by new technologies. Allow users to express their creativity, make it available to a large audience and get feedback and recognition. Networking and collaboration between teachers across different countries. Cooperation among schools to share 'next practice' and spread applied knowledge (Hargreaves, 2003).
Positive attitude and adaptability	Appropriation of technology can foster creativity and innovation only when users develop a positive attitude in adapting new technologies. This is applicable for both teachers and students (Hinkley, 2001).
Users as innovators Participatory culture	Harnessing the emerging and increasing role of the user in the innovation-development process. Appropriation of technology can range from simple reproduction to sophisticated creation. Learning new ways of doing things (Loveless, 2008; Turvey, 2006; Lindmark, forthcoming 2009; Borgnakke, 2006).
Learning how to learn	This facilitates creative learning, as it enables users to use technology to learn in new, creative ways (Rogers, 1983).
Technology Skills / Training	Technology skills as a prerequisite for both creative learning and innovative teaching for students and teachers. Teacher training (Ala-Mutka, 2008; Herold, 2009; Rowlands, 2008; Shaffer, 2006).
Games which are appropriate for education purpose	Games have shown positive impact on motivation, self-confidence, different learning rhythms of students and in the way students deal with mistakes (Wastiau et al., 2009).

Table 9: enabler area 7 – technology

5.8. Tools

Finally, other tools play a part in boosting innovative teaching and creative learning. These include physical spaces and resources.

Enablers	Description and references
Tools	
Resources	Manipulatives, realia, innovative textbooks, interactive resources (Simplicio, 2000).
Spaces	Space (for creativity – open spaces, building of the classroom); a total environment where tools, spaces and mindsets are stimulating creativity and thinking. The smarter the environment, the smarter the people. The creation of different spaces where students can engage with technology (Taylor, 1988; Gardner, 1999; West-Burnham, 2000; Burke, 2007).
Networking	The possibility to share good practice, virtually or face-to-face (Hargreaves, 2003).

Table 10: enabler area 8 - tools

5.9. Major points

In order to foster creative learning and innovative teaching, a series of conditions must be in place. These conditions were deduced using a two-fold method: a categorisation of enablers extracted from the literature review and a group activity during a scoping workshop with experts. The enablers were then clustered into eight areas, namely: Assessment; Culture; Curriculum; Individual skills; Teaching and learning format; Teachers; Technology; Tools.

6. CONCLUSIONS

This report has provided an overview of how creativity and innovation are conceptualised in the context of education and the emergence of a knowledge society. The existing research on creativity and innovation is broad, complex and addresses multi-faceted concepts. For this study, creativity and innovation are understood as interrelated concepts; the first refers to a product or process which shows a balance of originality and value, and the second to the implementation of such a process or product in a given sphere.

The notion of creativity has been researched in various fields and approached in several ways. This report shows that creativity can be linked to different factors, residing both in the individual (cognitive abilities, thinking skills, personality traits, knowledge), and in the surrounding sphere (culture, environment, field and domain). Creativity can be linked to cognitive and thinking processes as much as to emotional states, such as intrinsic motivation and affective learning processes. To sum up, all the theories studied indicate that creativity is context dependent, and arises in the interplay of a number of factors and requisites which can be supported and/or suppressed.

This report has argued that creativity and innovation are strongly interrelated but it has also proposed a differentiated approach for the field of education in which creativity is more strongly linked to learning, and innovation to teaching, hence the notions of *creative learning* and *innovative teaching*. Research indicates that, for a multitude of reasons, creativity is currently not at the centre of education practices. This suggests that there is a need for a change in pedagogy towards a more permissive environment which cherishes students' ideas, encourages risk-taking and mistakes, and allows learners to assume ownership of their learning. The traditional configuration of school space, time and structure also needs a shift and re-organisation for creativity to blossom.

Creativity and innovation in education are not just an opportunity, but a necessity. This work highlights an inclusive and democratic perspective of creativity, which sees all people as capable of being creative from early childhood. However, whether people develop their creativity depends on the kind of training they receive. Accordingly, creativity should be understood as a skill which may be developed through creative learning and innovative teaching. The fostering of such skill depends substantially on the development of curricula, where a balance among the different subject areas, between prescription and freedom and in agendas should be a priority. Assessment in schools also needs to be addressed as current methods often do not take into account creativity and may even stifle it.

The rapid development and take up of technology, especially by young people, has a significant impact on education, challenging educators and institutions to address the changed learning patterns and needs of their students. The emergence of social computing applications, in particular, allows for personalisation of learning paths, making learning opportunities tailored to the individual's needs a reality. New digital formats employing a variety of media tools open up new sources and resources for creative expression. Collaboration and networking services offer further opportunities to develop creative ideas in cooperation with others. Both creativity and ICT require the re-definition of the role of the teachers as enablers, motivators, mentors and coaches of learning processes that are essentially owned and controlled by the learners themselves.

The fostering of creativity and innovation cannot rely on the intention of educators and pupils, as there are several conditions to be met to promote a creative and innovative learning environment. Therefore, a set of 'enablers' is proposed as a framework for understanding the conditions or the support mechanisms that allow creative learning and innovative teaching to emerge, and thus facilitate creativity and innovation. These are: assessment; culture; curriculum; individual skills; teaching and learning format; teachers; technology; and tools.

In conclusion, this report provides a theoretical grounding and a working definition for creativity and innovation. It also explores the role and function of creativity and innovation in the educational domain and the factors which are likely to enable or inhibit creative learning and innovative teaching. Finally, it analyses the role and potential of ICT and in particular, social computing, in fostering creativity and innovation in education.

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Abstract

This report provides a brief overview of the theoretical foundations for creativity and innovation in the context of education, as a background for the other planned reports. It attempts to define creativity and innovation in the educational context and provide an overview of research on creativity and innovation, especially for creative learning and innovative teaching. This work aims to capture the fruitful interdisciplinary debate on the role of Creativity and Innovation in the knowledge society and different schools of thought contributing to this debate.

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